

R E P O R T  
ON THE  
HEALTH OF SOUTH SHIELDS,  
FOR THE YEAR 1881.

BY  
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MEDICAL OFFICER OF HEALTH FOR THE BOROUGH.

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# ANNUAL REPORT, 1881.

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## PART I.

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### SICKNESS AND MORTALITY.

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During the fifty-two weeks ending 31st December, 2274 births and 1063 deaths were registered within the Borough.\* The excess of births over deaths being 1211.

POPULATION.—During the last few years the population has been considerably over-estimated, 62,000 being the number estimated for the year 1880, whereas at the census taken in April, 1881, it was found to be only 56,875; the excess of births over deaths from that month to the end of the year is 917, thus bringing up the population to 57,792.

BIRTHS.—The birth-rate per 1000 is 39·8; the average rate of England being 33·9.

DEATHS.—The deaths represent the lowest rate for South Shields on record, being 18·6 per 1000.

AGES AT DEATH.—Of the 1063 deaths, 288 were those of infants under 1 year, 145 occurred between the ages 1 and 5, 55 between 5 and 15 years, 51 between 15 and 25, 293 between 25 and 60, and 231 of persons aged 60 years and upwards.

ZYMOTIC DISEASES.—The following deaths were registered during the year from the seven principal zymotic diseases, viz.:—small-pox 1, measles 26, scarlet fever 11, diphtheria 2, whooping cough 10, Fever 18, diarrhoea 24. The total, 92, representing a death rate of 1·6 per 1000.

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\* Including deaths that occurred in the Workhouse situated without the Borough, amongst persons belonging to South Shields.



**SMALL-POX.**—In the month of June, a man suffering from this disease was reported to me by a Medical Practitioner of the town. On investigation I found that the patient, a seaman living in a tenemented house, had a few days previously arrived from Bilboa, where small-pox was raging, and where he had without doubt contracted the disease. About ten days after the case was reported to me, I found his wife and one of his children suffering from the same disease. No other case arose from this outbreak. In December, a death from small-pox was registered in the Borough. The case was that of a seaman who was removed by the Port Sanitary Authority from a vessel lying in the river to the Floating Hospital at Jarrow Slake.

**MEASLES.**—Twenty-six deaths from this disease were registered. One occurred in January, one in March, one in September, ten in October, eight in November, and five in December. In October this disease assumed the form of an epidemic, four public schools being affected, two of them rather severely. The outbreak was traced to one family, some of the members being allowed to attend school while the disease was in the house. I visited more than two hundred cases, and of that number not more than twenty were attended by any medical man, so that no precautions were taken to prevent the spread of the disease, the patients being allowed to mix freely with other children, and in a few cases allowed to go to school before they were properly recovered. The outbreak was confined to the four schools, and soon showed signs of having been checked after proper measures had been taken, the town being almost free of it at the end of the year.

**SCARLET FEVER.**—This disease caused ten deaths during the year. A rather smart outbreak occurred in the month of January, at East Jarrow. Seven cases were reported to me, all within three or four days of each other; four of them I found living in a tenemented house, where there were no less than fifteen children. All the cases were traced to one source, viz., a girl who had returned from a neighbouring town while suffering from a mild form of the disease. The disease was confined, by the precautionary measures taken, to the seven cases reported.

**DIPHTHERIA.**—Two deaths occurred from this disease, both cases being young children. No cause could be assigned for either of these, the premises being in a perfect sanitary condition.

**WHOOPING COUGH.**—This disease, which caused eleven deaths, was prevalent in the town during the third quarter of the year.

**TYPHUS FEVER.**—No death occurred from this disease during the year.

ENTERIC FEVER.—Fourteen deaths were registered from this disease, eight of which occurred during the last four months of the year. In all the cases the premises were examined, and where sanitary defects were found to exist, immediate steps were taken to remedy the same.

DIARRHŒA.—Diarrhœa caused twenty-four deaths during the year, seven of which occurred during the third quarter of the year; the number of deaths from this disease during the corresponding quarter of the previous year being sixty-five.

LOCAL DISEASES.—Of the 1063 deaths registered during the year, 185 were caused by bronchitis, pneumonia, and pleurisy; 86 being children under 5 years of age. 35 of the deaths occurred in district II, sub-division 1; 29 in district III, sub-division 3; 21 in district I, sub-division 1; and 18 in district IV, sub-division 2. From the above it will be seen that the districts most affected are those composed of comparatively new houses with bad sub-soil, an evil to which I have before drawn attention, and as a remedy, I would particularly draw the attention of the Urban Sanitary Authority to the following sections of the New Building Bye-laws now under consideration.

10.—Every person who shall erect a new domestic building shall cause the whole ground surface or site of such building to be properly asphalted or covered with a layer of good cement concrete, rammed solid, at least *six inches* thick.

11.—Every person who shall erect a new building shall cause such building to be enclosed with walls constructed of good bricks, stone, or other hard and incombustible materials, properly bonded and solidly put together:—

(a.) With *good mortar* compounded of good lime and *clean sharp sand*, or other suitable material; or

(b.) With good cement; or with good cement mixed with clean sharp sand.

17.—Every person who shall erect a new building shall cause every wall of such building to have a proper damp course of sheet lead, asphalt, or slates laid in cement, or of other durable material impervious to moisture, beneath the level of the lowest timbers, and at a height of not less than *six inches* above the surface of the ground adjoining such wall.

56.—Every person who shall erect a new domestic building shall so construct every room which shall be situated in the lowest storey of such building, and shall be provided with a boarded floor, that there shall be, for the purpose of ventilation, between the under side of every joist on which such floor may be laid, and the upper surface of the asphalt or concrete with which, in



pursuance of the bye-law in that behalf, the ground surface or site of such building may be covered, a clear space of *three inches* at the least in ever part, and he shall cause such space to be thoroughly ventilated by means of suitable and sufficient air-bricks, or by some other effectual method.

60.—Every person who shall erect a new building shall cause the subsoil of the site of such building to be effectually drained by means of suitable earthenware field pipes, properly laid to a suitable outfall, whenever the dampness of the site renders such a precaution necessary.

He shall not lay any such pipe in such a manner or in such a position as to communicate directly with any sewer or cesspool, or with any drain constructed or adapted to be used for conveying sewerage, but shall provide a suitable trap, with a ventilating opening, at a point in the line of the subsoil drain as near as may be practicable to such trap.

PHTHISIS.—Phthisis caused 97 deaths. Districts I, II, III showing the highest mortality; the rate per 1000 being equal to 1·7.

HEART DISEASE.—This disease caused 79 deaths, the mortality rate representing 1·4 per 1000.



## PART II.

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### ACTION TAKEN TO PREVENT THE SPREAD OF DISEASE.

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During the year 24 cases were removed to the Borough Infectious Hospital, viz., small-pox 3, enteric fever 12, scarlet fever 8, measles 1.

**SMALL-POX.**—On the 13th June, a case of small-pox was reported to me by a Medical Practitioner. The patient, a seaman living in a tenemented house in Thomas street, arrived in the town on the 9th from Bilboa. He was immediately removed to the Infectious Hospital, the bedding destroyed, and the house thoroughly fumigated by Mr. Hindmarch, the Sanitary Inspector. I visited the house daily, and examined all the inmates. On the 20th, I found the patient's wife and one of his children suffering from the disease in the premonitory stage; they were also immediately removed to the Hospital. The house was again fumigated and visited daily for three weeks, but no other outbreak occurred. In the month of December, a case was removed from a vessel lying in the river to the Floating Hospital by the Port Sanitary Authority. As the patient had several times visited the town while suffering from this disease, I at once took steps to ascertain the houses frequented by him, and the persons with whom he had been in contact. I found that he had been in one private house and a public Music Hall, both of which were fumigated. Several persons who had been in his company were closely watched. Four men, two women, and one child contracted the disease from this case; they were all removed to the Hospital. The outbreak has since been stamped out.

**SCARLET FEVER.**—An outbreak occurred in the month of January at East Jarrow. Four cases were removed to the Hospital from one tenemented house; the house, clothing, bedding, &c., were fumigated, the children kept from school for a short time. Three cases found in other houses were isolated, and the same precautionary measures, with the desired effect, the disease being effectually checked.

**ENTERIC FEVER.**—Eleven cases of this fever were removed to the Infectious Hospital during the year, four of them from the Workhouse, and the remainder from houses where there was a want of proper accommodation. Fourteen deaths occurred within the Borough, in all the cases the premises were examined, and where sanitary defects were found to exist, immediate steps were taken to remedy the same. In some of the houses drains were found under the houses with the joint open, and neither traps nor ventilation to intercept the gas from the sewers.

# PART III.

## SANITARY WORK.

### SECTION I.

#### INSPECTIONS AND THE ABATEMENT OF NUISANCES INJURIOUS TO HEALTH.

Every portion of the Borough is visited periodically for the detection of nuisances injurious to health, and a house-to-house inspection is at present being made throughout the town, particular attention being paid to ashpits and drainage, the old privy ashpit being gradually superseded by the dry ash receptacle, resulting in a marked improvement in the health of the Borough. East Jarrow and Wilson street, where this system has been adopted being most conspicuous. During the year, 98 privy ashpits have been removed and dry receptacles substituted. Where the drains are found defective it is in the majority of the cases due to water-closet, &c., running into the sewers without either syphon or ventilators.

NUISANCES.	TOTAL. BOROUGH. 1881.	DISTRICT I. North of King Street and Ocean Road.	DISTRICT II. South of Ocean Road.	DISTRICT III. Mill Dam Valley, Green's Estate, East Holborn.	DISTRICT IV. West Holborn, Corstor- phine & Temple Towns.	DIVISION V. Tyne Dock and East Jarrow.
Houses unfit for habitation ...	27	12	1	4	8	2
Dilapidated and ill-constructed houses and premises... }	12	6	3	2	1	...
Privy-middens, so situated as to be a nuisance; and requiring for the abatement of the nuisance the removal of the midden, and the provision either of water closets or dry privy receptacles..... }	122	9	3	48	7	55
Want of proper means of drainage of houses or land }	20	3	13	3	...	1
Want of ventilation in dwellings ..... }	7	1	1	5	...	...
Defective slaughter houses ...	...	...	...	...	...	...
Unpaved private yards or passages ..... }	2	1	...	...	...	1
Cellar dwellings .....	13	...	...	10	1	2



The following is a list of nuisances, similarly classified, for which statutory notices were also served, but for the abatement of which structural works were not required.

NUISANCE.	TOTAL— BOROUGH. 1881.	DISTRICT I.	DISTRICT II.	DISTRICT III.	DISTRICT IV.	DISTRICT V.
Defective drains, privies, } and water-closets .....	393	69	67	204	22	31
Houses, rooms, and passages } so filthy as to be a nuisance }	661	202	77	285	55	42
Nuisances arising through } absence of water supply for } domestic services .....	28	23	5	...	...	...
Overcrowding ..	11	2	...	5	2	2
Offensive accumulation of } refuse .....	140	84	3	28	6	19
Animals kept so as to be a } nuisance .....	8	2	2	1	1	2
Water in Ashpits .....	9	...	...	7	2	...

## SECTION II.

### ADVICE TO SANITARY AUTHORITY.

NUISANCES.—2992 notices were served during the year by the Sanitary Inspector.

HOSPITAL ACCOMMODATION.—Infectious cases are still accommodated in the building formerly rented from the Poor-Law Guardians. The new Hospital is now being proceeded with.

PAVING OF STREETS AND LANES, VENTILATION OF SEWERS.—Twenty-two front streets, and twenty-three back, have been paved during the year. Twelve shaft and fifteen surface ventilators have been connected with the sewers.

## SECTION III.

### DEPARTMENTAL WORK.

- 1.—ACTION ON RECEIVING INFORMATION OF THE OUTBREAK OF ANY INFECTIOUS DISEASE (Article 6).—Recorded on page      and Table II.
- 2.—NUISANCES AND OVERCROWDING (Article 7).—The number of notices served and action taken are given in Table I.



- 3.—FOOD SUPPLY.—The amount and nature of the food that has been destroyed as unfit for human consumption will be seen in Table III.
- 4.—LODGING HOUSES.—There are 50 common lodging houses registered, all of which were frequently visited and found to be in a good sanitary condition. No proceedings have been taken for infringing the bye-laws. Two cases of fever were removed from one house.
- 5.—SLAUGHTER HOUSES AND BAKE HOUSES.—These have been frequently inspected, and the regulations for the removal of refuse, cleansing, &c., have been observed.
- 6.—CHEMICAL WORKS.—Complaints of escape of obnoxious gases from the chemical works continue to be made from time to time. I have forwarded notices of their complaints to the Government Inspector.
- 7.—DAIRIES, COW-SHEDS, AND MILK SHOPS.—There are 16 dairies, &c. registered, all of which have been found on inspection to be kept in accordance with bye-laws.

In conclusion, I may state that the duties of this department have been performed by Mr. Hindmarch, the Sanitary Inspector, in a most careful and efficient manner.

## APPENDIX [A.]

*INSPECTOR OF NUISANCES' REPORT.*

TABLE I.—STATUTORY NOTICES ISSUED FROM HEALTH OFFICE DURING YEAR 1881.

1.—COMMON NUISANCES.	
To remedy defective drainage, defective and dilapidated privies, ashpits, and water-closets .....	376
To whitewash and purify houses, rooms, and passages .....	633
To remove offensive accumulations of refuse .....	140
To provide water-closet accommodation .....	20
„ „ drainage to houses and land .....	20
„ „ water supply to houses .....	28
To pave yards and passages .....	2
To remove animals kept so as to be a nuisance .....	8
„ „ stables do. do. ....	4
„ „ privy-middens and substitute improved forms of closet accommodation .....	98
To cleanse privy-middens and to remove liquid therefrom .....	13
To repair or alter dilapidated and ill-constructed houses and rooms .....	12
Notices as to houses unfit for habitation .....	27
„ „ closed .....	10
Occupying cellar-dwellings unlawfully .....	13
2.—OVERCROWDING AND INSUFFICIENT VENTILATION.	
To abate overcrowding in houses .....	11
To provide more efficient ventilation in houses, shops, and schools .....	3
To consume smoke .....	4
3.—LODGING HOUSES.	
To register common lodging houses .....	2
To abate overcrowding in lodging houses .....	...
To whitewash and cleanse slaughter houses .....	2
<hr/>	
Total Statutory Notices served during the year .....	1426
Verbal Notices .....	1568
<hr/>	
Total .....	2994

TABLE II.—INFECTIOUS DISEASES IN HOUSES.

Number of houses visited in consequence of presence of infectious disease* .....	70
Number disinfected under supervision .....	33
Number disinfected by Inspector .....	17
Notices served to disinfect .....	33
Beds destroyed.....	5
Pillows ,, .....	8

\* All of these were visited several times.

TABLE III.—UNWHOLESOME FOOD DESTROYED.

7 Pigs.....	22 stones. No proceedings.
6 Chickens.....	Fined 20s. and costs.

A large quantity of meat, reported unsound, was examined by not seized, the medical officer considering it not unfit for food.

TABLE IV.—PROCEEDINGS BEFORE THE JUSTICES.  
NUISANCES.

DESCRIPTION.	No. of Cases.	Result.	Penalties.
Defective privy accom- modation	3	Orders to abate the nuisances. In each case in the terms of the notice; <i>i.e.</i> , to remove middenstead and provide other form of closet accommodation	Costs.

FOOD AND DRUGS ACT.

The undernoted have been examined by the Public Analyst.

DESCRIPTION OF ARTICLES.	No. of Samples.	Result.	Penalties.
Milk—Number of Cases taken	27	Adulterated (1) .....	...
Milk sent to Analyst .....	5	Genuine (4).....	...
Sweets .....	1	Genuine .....	...



# APPENDICES.

## APPENDIX [A.1.]

*DEATHS FROM VARIOUS DISEASES, AT CERTAIN AGES,  
AND CLASSIFIED ACCORDING TO LOCALITIES.*

## DISTRICT No. I.

*The District situated between the Market Place, King Street, and Ocean Road,  
on the South-East, and the River on the North West.*

SUB-DIVISION 1.—That part of the District West of Mile-end Road.

[illegible]

## DISTRICT No. I.—SUB-DIVISION 1.—(Continued.)

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Phthisis.	Inflammatory Lung Diseases
Brought forward.....	3	...	1	...	...	...	...	...	...	...	3	4
Lady's Walk....	...	...	...	...	...	...	...	...	...	...	...	...
Long Bank .....	...	...	...	...	...	...	...	...	...	...	...	...
Mill Street .....	...	...	...	...	...	...	...	...	...	...	...	1
Mile-end Road .....	...	...	...	...	...	...	...	...	...	...	...	...
Mitre Street .....	...	1	...	...	...	1	...	...	...	...	...	...
Market Place .....	...	...	...	...	...	...	...	...	...	...	...	...
Mason Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
North Street.....	...	...	...	...	...	...	...	...	...	...	...	...
North Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
Palatine Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Philip's Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Price Street .....	...	1	...	...	...	...	...	...	...	...	1	...
Queen Street.....	1	...	...	...	...	...	...	...	...	...	1	2
Soulsby's Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Salem Street .....	...	...	...	...	...	...	...	...	...	...	...	1
Spring Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
Stob Lane.....	...	...	...	...	...	...	...	...	...	...	...	...
Studley Stairs .....	...	...	...	...	...	...	...	...	...	...	...	...
Shotton's Stairs .....	...	...	...	...	...	...	...	...	...	...	...	...
Society Stairs .....	...	...	...	...	...	...	...	...	...	...	...	...
Saltwell Lane .....	...	...	...	...	...	...	...	...	...	...	1	1
Tyne Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Thrift Street.....	...	1	1	...	...	...	...	...	...	...	1	...
Trobe's Bank .....	...	...	...	...	...	...	...	...	...	...	...	...
Thames Lane .....	...	...	...	...	...	...	...	...	1	...	...	...
Thames Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Thames Street .....	...	1	...	...	...	...	...	...	...	...	...	5
Union Alley .....	...	...	...	...	...	...	...	...	...	...	...	...
Wellington Street.....	2	1	1	...	...	...	...	...	...	...	...	3
Walker's Buildings .....	1	1	2	...	...	...	...	...	...	...	...	1
Wapping Street .....	...	2	...	1	...	...	...	...	...	...	...	2
Wellington Place .....	...	...	...	...	...	...	1	...	...	...	...	...
Wilson's Dock .....	...	...	...	...	...	...	...	...	...	...	...	...
Totals.....	7	8	5	1	...	1	1	...	1	...	7	20



## APPENDIX [A.2.]

DISTRICT No. I. SUB-DIVISION 2.—East of Mile-end Road.

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Phthisis.	Inflam. Lung Dis.
Alderson Street .....	1	...	...	...	...	...	...	...	...	2	1	...
Bath Street .....	...	...	...	...	...	...	...	...	...	1	2	...
Blumer's Terrace.....	...	...	...	...	...	...	...	...	...	...	...	...
Byron's Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
Balcony Lane and Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Baring Street .....	...	1	1	...	...	...	...	...	...	1	...	...
Cleveland Street .....	1	2	...	...	...	...	...	...	...	...	3	2
Coble Landing .....	...	...	...	...	...	...	...	...	...	...	...	...
Custom-house Quay .....	...	...	...	...	...	...	...	...	...	...	...	...
Davison's Lane.....	...	...	...	...	...	...	...	...	...	...	...	...
Edith Street .....	...	...	...	...	...	...	...	...	...	...	1	...
Fort Street .....	...	1	...	...	...	...	...	1	...	...	...	1
Green's Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Green's Place .....	1	...	...	...	...	...	...	...	...	...	...	...
Grubb's Buildings .....	...	...	...	...	...	...	...	...	...	...	...	...
Hedley Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Henry Street.....	...	...	...	...	...	...	...	...	...	...	1	...
Heugh Terrace.....	...	...	...	...	...	...	...	...	...	...	...	...
Heugh Court.....	...	...	...	...	...	...	...	...	...	...	...	...
Hospital Quay .....	...	...	...	...	...	...	...	...	...	...	1	...
Ingham Street .....	...	1	1	...	...	...	...	...	...	...	1	...
James Mather Street .....	...	...	1	...	...	...	...	...	...	...	...	...
John Clay Street .....	...	1	1	...	...	...	...	...	...	...	...	...
Lawe Cottages .....	...	...	...	...	...	...	...	...	...	...	...	...
Lawe Buildings .....	...	...	...	...	...	...	...	...	...	...	...	...
Lawson's Bank .....	...	...	...	...	...	...	...	...	...	...	...	...
Lawson's Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
Livingstone Street .....	1	...	...	...	...	...	1	...	...	...	3	1
Morton Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Military Road .....	...	...	...	...	...	...	...	...	...	...	2	...
Ocean Road .....	1	...	...	...	...	...	...	...	...	...	...	1
Ocean Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Pilot Stairs .....	1	...	...	...	...	...	...	...	1	...	...	...
Pilot Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Pearson Street .....	1	...	...	...	...	...	...	...	...	...	...	1
Rose Lane.....	...	...	...	...	...	...	...	...	...	...	...	...
Rudd's Bank .....	...	...	...	...	...	...	...	...	...	...	...	...
Salmon Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Salmon's Field .....	...	...	...	...	...	...	...	...	...	...	...	...
Stanhope Street .....	...	...	...	...	...	...	...	...	...	...	1	...
Stephen Street .....	...	...	...	...	...	...	...	1	...	...	...	...
Shadwell Street.....	...	...	...	...	...	...	...	...	...	...	...	...
Salmon's Quay .....	...	...	...	...	...	...	...	...	...	...	...	...
Wawn Street.....	...	2	2	...	...	...	...	...	...	...	...	...
Workhouse .....	...	...	...	...	...	...	...	...	...	...	...	...
Totals.....	7	8	6	...	...	...	1	2	1	4	16	6

## APPENDIX [A.3.]

## DISTRICT No. II.

*District extending from South side of Ocean Road to Borough boundary beyond Westoe, bounded on the N.W. by the Stanhope and Tyne Railway, and on the East by the Ocean.*

SUB-DIVISION 1.—That part of the District North of Westoe Village.

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Phthisis.	Inflam. Lung Dis.
Agnes Street.....	...	1	1	...	...	...	...	...	...	...	...	1
Albion Terrace.....	...	..	...	...	...	...	...	...	...	...	...	...
Albermarle Street.....	...	...	...	...	...	...	...	...	...	...	1	1
Albert Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Alma Street .....	...	1	1	...	...	...	...	...	...	...	..	1
Anderson Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Brodrick Street.....	...	...	...	...	1	...	...	...	...	...	..	..
Burrow Street .....	1	...	...	...	...	...	...	...	1	...	...	1
Bent Cottages .....	...	...	...	...	...	...	...	...	...	...	...	..
Charlotte Street .....	...	...	...	...	...	...	...	...	...	...	...	1
Challoner Terrace.....	...	...	...	...	...	...	...	...	...	...	...	..
Challoner Grove .....	...	...	...	...	...	...	...	...	...	...	...	...
Chichester Road .....	...	...	...	...	...	...	...	...	...	...	...	..
Catherine Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Charlotte Terrace.....	...	...	...	...	...	...	...	...	...	1	1	...
Dale Street .....	1	1	...	...	...	...	...	...	...	...	2	2
Derby Street (West).....	...	...	...	...	...	...	...	...	...	...	...	1
Denmark Street.....	...	...	...	...	...	...	...	...	...	...	1	...
Derby Terrace .....	...	1	...	...	...	...	...	...	...	...	1	1
Eleanor Street .....	...	...	...	...	1	...	...	...	...	...	...	...
Eastbourne Grove.....	1	...	...	...	...	...	...	...	...	2	2	...
Eleanor Grove .....	...	...	...	...	...	...	...	...	...	...	...	...
Elizabeth Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Fowler Street .....	...	...	...	...	...	...	...	...	...	...	1	1
Franklin Street.....	2	2	1	...	...	1	...	...	...	...	...	2
Gardner Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Garden Lane.....	...	...	...	...	...	...	...	...	...	...	1	...
Garden Street .....	...	...	...	...	...	...	...	...	...	...	...	...
George Potts Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Grace Street .....	...	...	...	...	...	...	...	...	...	...	1	..
Ivy Street .....	...	...	...	1	...	...	...	...	...	...	...	1
Ingham Place .....	1	1	...	1	...	...	...	...	...	1	...	...
John Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Kepple Street .....	...	...	...	...	...	...	...	...	...	...	...	..
Mariners' Cottages .....	...	...	...	...	...	...	...	1	1	...	...	...
Marine Approach .....	...	...	...	...	...	...	...	...	...	...	...	..
Marsden Street .....	1	1	...	...	..	1	...	...	...	...	...	1
Meldon Terrace.....	...	...	...	...	...	...	...	...	...	...	1	2
Carried forward .....	7	8	3	2	2	2	...	1	2	4	12	16



## DISTRICT No. II. SUB-DIVISION 1.—(Continued.

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Phthisis.	Inflam. Lung. Dis.
Brought forward.....	7	8	3	2	2	2	...	1	2	4	12	16
Milton Street .....	1	1	...	...	...	1	...	..	...	...	2	2
Ogle Terrace.....	...	...	...	...	...	...	...	...	...	...	...	...
Pier Terrace.....	1	...	...	...	...	...	...	...	...	...	...	1
Percy Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Ravensbourne Terrace.....	...	...	...	...	...	...	...	...	...	...	...	...
Romilly Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Stevenson Street .....	...	...	...	...	...	...	...	...	...	...	...	1
Seafeld Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Somerset Street .....	1	...	...	...	...	...	1	...	...	...	1	2
Salisbury Place .....	...	...	...	...	...	...	...	...	...	...	...	...
Saville Street .....	...	1	...	...	...	...	...	...	...	...	...	1
Sunny Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Shortridge Street .....	...	1	...	...	...	...	1	...	...	...	1	2
Sea View Terrace.....	...	...	...	...	...	...	...	...	...	...	...	...
Thomas Street .....	1	...	...	...	...	1	..	...	...	...	...	...
Victoria Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Victoria Place .....	...	1	1	...	...	...	...	...	...	...	1	...
Winchester Street.....	1	...	...	...	...	1	...	...	...	...	...	1
William Street .....	...	...	...	...	...	...	...	...	...	...	1	...
Winterbottom Street .....	...	...	...	...	...	...	...	...	...	...	...	1
Woodbine Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Wellington Terrace .....	...	...	...	...	...	...	...	...	...	...	...	1
Westoe Lane.....	...	...	...	...	...	...	...	...	...	...	...	...
Wouldhave Street.....	...	1	1	...	...	...	...	...	...	...	...	1
Wawn Street.....	...	...	...	...	...	...	...	...	...	...	...	...
Totals .....	12	13	5	2	2	5	2	1	2	4	18	29

## APPENDIX [A.4.]

## DISTRICT No. II. SUB-DIVISION 2.—Westoe Village.

[illegible]



## APPENDIX [A.5.]

## DISTRICT No. III.

*The District situated between King Street on the N.E., Laygate Street and Laygate Lane on the S.W., the River on the N.W., and the Stanhope and Tyne Railway on the S.E.*

SUB-DIVISION 1.—That part of the District to the West of the Passenger Line.

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Phthisis.	Inflammatory Lung Diseases
Academy Hill .....	1	1	...	...	...	...	...	...	...	...	...	...
Addison Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Bottle Bank and Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Brewery Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
Commercial Road.....	...	...	...	...	...	...	...	...	...	...	2	2
Cowan's Place .....	...	...	...	...	...	...	...	...	...	...	...	...
Carpenter's Hill .....	...	...	...	...	...	...	...	...	...	...	...	...
Cone Street .....	...	...	...	...	...	...	...	...	...	...	2	2
Chapel Hill, Johnson's Hill.....	...	...	...	...	...	...	...	...	...	...	...	...
Dockwray's Bank .....	...	...	...	...	...	...	...	...	...	...	...	...
East Holborn .....	...	...	...	...	...	...	...	1	...	...	1	1
Forrest's Hill .....	...	...	...	...	...	...	...	...	...	...	...	...
Hill Street .....	1	...	...	...	...	...	...	...	...	...	...	1
Henderson's Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
Harrison's Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Johnson's Hill .....	...	...	...	...	...	...	...	...	...	...	...	...
Laygate Hill.....	...	...	...	...	...	...	...	...	...	...	...	...
Laygate Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Laygate Street .....	1	...	...	...	...	...	...	...	1	...	2	1
Mill Dam .....	...	...	...	...	...	...	...	...	...	...	...	...
Nile Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Nelson's Bank .....	...	...	...	...	...	...	...	...	...	...	...	...
Pleasant Place .....	1	...	...	...	...	...	2	...	...	...	...	2
Pratt's Bank.....	...	...	...	...	...	...	...	...	...	...	...	...
Paine's Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
Pleasant Cottage .....	...	...	...	...	...	...	...	...	...	...	...	...
Roper's Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Swan Hill .....	...	...	...	...	...	...	...	...	...	...	...	...
Todd's Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Tiney Street.....	...	...	...	...	...	...	...	...	...	...	...	...
Wawn's Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Willow Cottages .....	...	...	...	...	...	...	...	...	...	...	...	...
West Dock .....	...	...	...	...	...	...	...	...	...	...	...	...
Totals .....	1	3	1	...	...	...	2	1	1	...	7	9

## APPENDIX [A.6.]

## DISTRICT No. III.

SUB-DIVISION 2.—That part of the District East of the Passenger Line, and North-East of Claypath Lane.

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.								
	Under 1.	1 and Under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Inflammatory Lung Diseases
Barrington Lane .....	...	...	...	...	...	...	...	...	...	...	...
Barrington Street.....	...	...	...	...	...	...	...	...	...	...	...
Chapter Row.....	...	...	...	...	...	...	...	...	...	...	...
Church Row .....	...	...	...	...	...	...	...	...	...	...	...
Coronation Street.....	...	1	...	...	...	...	...	...	...	...	3
Cornwallis Street .....	...	1	...	...	...	...	...	...	...	...	2
Dove Court .....	...	...	...	...	...	...	...	...	...	...	...
East Street .....	...	...	...	...	...	...	...	...	...	...	...
Fairbairn's Court.....	...	...	...	...	...	...	...	...	...	...	...
Hilda Pit Yard.....	...	...	...	...	...	...	...	...	...	...	...
Hepple's Court.....	...	...	...	...	...	...	...	...	...	...	...
Kepple Street (West) .....	1	...	...	...	...	...	...	...	...	1	1
Kepple Court .....	...	...	...	...	...	...	...	...	...	...	...
Mount Terrace .....	...	...	...	...	...	...	...	...	...	...	1
Nelson Street .....	...	...	...	...	...	...	...	...	...	...	...
Oliver's Court .....	...	...	...	...	...	...	...	...	...	...	...
Oliver Street.....	...	...	...	...	...	...	...	...	...	...	...
Oyston Street .....	...	...	...	...	...	...	1	...	...	...	...
Oyston Court .....	...	...	...	...	...	...	...	...	...	...	...
Park Street .....	1	...	1	...	...	...	...	...	...	...	...
Russell Street .....	...	...	...	...	...	...	...	...	...	...	...
Readhead's Court.....	...	...	...	...	...	...	...	...	...	...	...
Railton's Court.....	...	1	1	...	...	...	...	...	...	...	...
Smithy Street .....	...	1	...	...	...	...	1	...	...	...	1
Waterloo Vale .....	1	...	...	...	...	...	...	...	...	...	1
Wallis Street.....	...	...	...	...	...	...	...	...	...	...	...
Waterloo Lane .....	...	...	...	...	...	...	...	...	...	...	...
West Street .....	...	...	...	...	...	...	...	...	...	...	...
Totals .....	3	4	2	...	...	...	2	...	...	1	9



## APPENDIX [A.7.]

## DISTRICT No. III.

SUB-DIVISION 3.—That part of the District East of Passenger Line, and South-West of Claypath Lane.

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Phthisis.	Inflammatory Lung Diseases
Adelaide Street.....	2	1	1	...	...	...	...	...	...	...	1	4
Bedford Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Brunswick Street.....	1	1	...	1	...	1	...	...	1	...	2	2
Brunswick Gardens .....	...	...	...	...	...	...	...	...	...	...	...	...
Cambridge Street.....	...	...	...	...	...	...	...	...	...	...	...	...
Claypath Lane .....	...	...	...	...	...	...	...	...	...	...	1	...
Cuthbert Street .....	2	...	...	...	...	...	...	...	...	...	...	2
Cotton's Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Derby Street.....	...	...	...	...	...	...	...	...	...	...	...	1
Dixon Street.....	...	...	...	...	...	...	...	...	...	...	...	...
Edward Street .....	...	...	...	...	...	...	...	...	...	...	1	1
Green Street .....	...	...	...	...	...	...	...	...	...	...	1	1
George Street .....	...	2	...	1	...	...	...	...	...	...	2	...
Hardwick Street ..	...	1	...	...	...	...	...	...	...	...	...	2
Laygate Terrace .....	...	1	...	...	...	1	...	...	...	...	...	...
Lawson Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Maxwell Street.....	4	2	1	...	...	1	1	...	...	1	1	4
Martin Street .....	...	1	...	...	...	...	...	...	...	...	...	1
Orange Street .....	...	1	...	...	...	...	...	...	...	...	...	1
Orange Place.....	1	...	...	...	...	...	...	...	...	...	...	1
Percy Street .....	1	1	1	...	...	...	...	...	...	...	...	1
Princes Street .....	...	...	...	...	...	...	...	...	...	...	1	...
Peel Street .....	...	1	...	...	...	...	...	...	1	...	1	...
Pallister Street.....	...	...	...	...	...	...	...	...	...	...	...	...
Raglan Street .....	1	...	...	...	...	...	...	...	...	...	1	1
Smith Street.....	...	...	...	...	...	...	1	...	...	...	...	...
Victoria Road .....	...	...	...	...	...	...	...	...	...	...	1	1
Wilson Street .....	2	1	...	...	...	...	...	1	1	1	5	1
Totals.....	14	13	3	2	...	3	2	1	3	2	18	24



## APPENDIX [A.8.]

## DISTRICT No. IV.

*District extending from Laygate Street and Laygate Lane South-West to the Dean Burn, bounded on the South-East by the Stunhope Line, and on the North-West by the River.*

SUB-DIVISION 1.—That part of the District situated West of the  
Passenger Line.

[illegible]

## DISTRICT No. IV.—SUB-DIVISION 1.—(Continued.)

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Phthisis.	Inflammatory Lung Diseases
Brought forward.....	...	...	...	...	...	...	...	...	...	...	...	...
Railway Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Richard Street .....	1	...	...	...	...	...	...	...	...	...	...	1
Robson Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Simon Street.....	1	...	1	...	...	...	...	...	...	...	...	...
Stackyard .....	...	...	...	...	...	...	...	...	...	...	...	...
Stableyard.....	...	...	...	...	...	...	...	...	...	...	...	...
Shepherd Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Station Cottages .....	...	...	...	...	...	...	...	...	...	...	...	...
Sanderson's Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Slake Row.....	...	...	...	...	...	...	...	...	...	...	...	1
Scullers' Landing.....	...	...	...	...	...	...	...	...	...	...	...	1
Smokey Row.....	...	...	...	...	...	...	...	...	...	...	1	...
Temple Town ..	...	...	...	...	...	...	...	...	...	...	...	...
Thornton Street .....	1	...	...	...	...	...	...	...	1	1	...	...
Turncoat Row .....	...	...	...	...	...	...	...	...	...	...	...	...
West Holborn .....	...	1	...	...	...	...	...	...	...	...	...	2
Weetman Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Windmill Hill .....	3	1	...	1	...	...	...	...	...	...	2	3
Waggonway Side .....	...	...	...	...	...	...	...	...	...	...	...	...
West Pan Place .....	...	...	...	...	...	...	...	...	...	...	...	...
Well Lane.....	1	...	...	...	...	...	...	...	...	...	...	1
Wright's Court....	...	...	...	...	...	...	...	...	...	...	...	...
Totals .....	9	4	1	1	...	...	...	...	1	1	6	18

APPENDIX [A.9.]

DISTRICT No. IV.

SUB-DIVISION 2.—That part of the District situated to the East of the Passenger Line.

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Phthisis.	Inflammatory Lung Diseases
Alexander Street .....	...	2	...	...	...	...	...	...	...	...	...	2
Alice Street .....	...	...	...	...	...	...	...	...	...	...	1	...
Barnes (The) .....	...	...	...	...	...	...	...	...	...	...	...	...
Broken Gardens .....	...	...	...	...	...	...	...	...	...	...	...	...
Berwick Street.....	...	...	...	...	...	...	...	...	...	...	...	...
Campbell Street .....	...	...	...	...	...	...	...	...	...	...	1	...
Clarendon Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Conway Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Deans (The).....	...	...	...	...	...	...	...	...	...	...	...	...
Dean Brewery .....	...	...	...	...	...	...	...	...	...	...	...	...
Dean Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Eldon Street.....	2	1	..	...	...	1	...	...	...	...	1	1
Francis Street .....	1	...	...	...	...	...	...	...	...	...	...	2
Florence Street.....	...	...	..	...	...	...	...	...	...	...	...	...
Frederick Street .....	1	...	...	1	...	...	...	...	...	...	1	1
Garden Walks .....	1	...	...	...	...	...	...	...	1	...	...	...
Gladstone Terrace .....	...	...	...	...	...	...	...	...	..	...	1	...
Havelock Street .....	1	...	...	...	...	...	...	...	...	...	1	1
John Williamson Street .....	1	3	...	...	...	...	...	...	2	...	1	2
Joseph Terrace.....	...	...	...	...	...	...	...	...	...	...	...	...
Laygate Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
Laygate Gardens .....	...	...	...	...	...	...	1	...	...	...	...	...
Palmerston Street .....	2	1	...	...	...	...	...	...	...	...	...	6
Reken Dyke Lane .....	...	...	...	...	...	...	...	...	...	...	1	1
Reed Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Trinity Court .....	...	...	...	...	...	...	...	...	...	...	...	...
Walpole Street.....	...	...	...	...	...	...	...	...	...	...	...	1
Totals .....	9	7	...	1	...	1	1	...	3	...	8	17



## APPENDIX [A.10.]

## DISTRICT No. V.

*The District extending from the Dean Burn to the River Don; bounded on the South-West by the Stanhope and Tyne Railway, and on the North-East by the River Tyne.*

## SUB-DIVISION I.—Tyne Dock, East of Leam Lane.

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhoea.	Other Zymotics.	Phthisis.	Inflam. Lung. Dis.
Bede Street .....	2	...	...	...	...	...	...	..	...	...	...	4
Dock Street .....	...	2	...	...	...	...	...	...	...	...	2	2
Dean Street .....	1	1	1	...	...	...	...	...	2	...	...	...
Frost Street .....	...	...	...	...	...	...	...	...	..	...	...	1
Fould (The) .....	...	...	...	...	...	...	...	...	...	...	1	1
Hudson Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Leam Lane .....	...	...	...	...	...	...	...	...	...	...	...	...
Lord Nelson Street .....	1	...	...	...	...	...	...	...	...	1	...	...
Marshall's Buildings .....	...	...	...	...	...	...	...	...	...	...	...	...
Napier Street .....	...	...	...	...	...	...	...	...	...	...	...	1
Slake Terrace .....	...	...	...	...	...	...	...	...	...	...	...	2
Tyne Dock .....	...	1	...	1	...	...	...	...	...	...	...	...
Tyne Street .....	...	2	2	...	...	...	...	...	...	...	...	...
Union Street.....	...	...	...	...	...	...	...	...	1	...	...	...
Watson Terrace .....	...	...	...	...	...	...	...	...	...	...	...	...
Whitehead Street.....	...	1	...	...	...	...	...	...	...	...	...	1
Watson's Buildings.....	...	...	...	...	..	...	...	..	...	...	...	...
Totals .....	4	7	3	1	...	...	...	...	3	1	3	12

## APPENDIX [A.11.]

## DISTRICT No. V. SUB-DIVISION 2.—East Jarrow, West of Leam Lane.

STREETS, COURTS, &c.	AGES		CERTAIN CAUSES.									
	Under 1.	1 and under 5.	Measles.	Scarlatina.	Diphtheria.	Whooping Cough.	Enteric Fever.	Other Fevers.	Diarrhœa.	Other Zymotics.	Phthisis.	Inflam. Lung Dis.
Bell Street .....	...	...	...	...	...	...	...	...	...	...	2	3
Cleveland Place .....	...	...	...	...	...	...	...	...	...	...	...	...
East Jarrow .....	...	...	...	...	...	...	...	...	...	...	1	...
Jarrow Lodge .....	...	...	...	...	...	...	...	...	...	...	...	...
Swineburne Street .....	...	...	...	...	...	...	...	1	...	...	...	...
Straker Street .....	...	...	...	...	...	...	...	...	...	...	...	...
Totals .....	...	...	...	...	...	...	...	1	...	...	3	3



## APPENDIX [B.]

## TABLE OF DEATHS

*During Year ending Decemler 31st, 1881, in the Urban Sanitary District of South Shields, classified according to Diseases, Ages, and Localities, and showing also the Population of such Localities, and the Births therein during the Year.*

SANITARY DISTRICTS.		Names of Localities adopted for the purpose of these Statistics; public institutions being shown as separate localities.	POPULATION AT ALL AGES. Census, 1881.	Registered Births.	MORTALITY FROM SUBJOINED CAUSES AT SUBJOINED AGES.							MORTALITY FROM SUBJOINED CAUSES, DISTINGUISHING DEATHS OF CHILDREN UNDER FIVE YEARS OF AGE.																					
					At all Ages.	Under 1 Year.	1 and under 5.	5 and under 15.	15 and under 25.	25 and under 60.	60 and upwards.		Small-pox.	Measles.	Scarlatina.	Diphtheria.	Croup (not "spasmodic").	Whooping Cough.	Continued Fevers.			Diarrhoea and Dysentery.	Cholera.	Rheumatic Fever.	Erysipelas.	Pyæmia.	Puerperal Fever.	Ague.	Phthisis.	Bronchitis, Pneumonia, and Pleurisy.	Heart Disease.	Injuries.	Other Diseases.
																			Typhus.	Enteric or Typhoid.	Other or Doubtful.												
I.	{	Sub-division 1.....	131	35	25	5	4	37	25	{	Under 5	...	8	1	...	...	1	...	...	...	...	...	...	...	...	...	...	1	9	1	1	37	
		Sub-division 2.....	108	32	8	6	7	30	25	{	5 upwds.	...	1	...	...	1	...	...	1	...	2	...	1	1	...	1	...	9	12	14	2	31	
II.	{	Sub-division 1.....	199	49	27	13	8	44	58	{	Under 5	...	9	1	...	1	5	...	...	2	3	...	1	...	...	...	...	...	16	...	...	86	
		Sub-division 2.....	4	2	...	...	...	2	...	{	5 upwds.	...	...	...	...	...	...	...	2	2	...	1	...	...	...	...	20	19	7	4	17		
III.	{	Sub-division 1.....	65	17	8	1	2	18	18	{	Under 5	...	1	...	...	...	...	...	2	1	...	...	...	...	...	...	...	2	...	...	21		
		Sub-division 2.....	52	11	8	5	1	16	11	{	5 upwds.	...	2	...	...	...	...	1	1	...	...	...	...	...	...	...	5	1	...	10			
		Sub-division 3.....	174	64	26	8	13	43	20	{	5 upwds.	...	2	2	...	...	2	...	2	...	4	...	1	3	...	...	1	15	...	...	60		
IV.	{	Sub-division 1.....	74	23	8	4	...	18	21	{	Under 5	...	1	1	...	...	...	...	...	1	...	...	...	...	...	...	1	10	...	...	17		
		Sub-division 2.....	108	32	22	8	4	24	18	{	5 upwds.	...	1	1	...	...	2	...	1	...	3	...	...	...	...	...	8	13	...	...	30		
V.	{	Sub-division 1.....	60	19	9	2	5	16	9	{	Under 5	...	...	1	...	1	...	...	...	3	...	...	1	...	...	...	...	5	...	...	18		
		Sub-division 2.....	16	2	2	1	2	8	1	{	5 upwds.	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	2	3	1	...	4		
(II) Public Institutions.	{	Fever Hospital .....	...	...	...	...	...	...	...	{	Under 5	...	...	1	...	...	...	...	3	...	...	...	...	...	...	...	...	...	1	...	...		
		Workhouse .....	51	2	1	...	3	23	22	{	5 upwds.	...	...	...	...	...	...	...	1	4	...	...	1	...	...	...	9	7	5	...	2		
TOTALS.....		57792	2274	1063	288	145	54	50	283	229	{	Under 5	...	25	8	...	3	10	...	1	...	17	...	1	5	...	...	4	86	2	2	266	
											{	5 upwds.	1	1	3	2	...	...	13	4	7	...	4	4	...	1	...	93	99	77	16	294	





## APPENDIX [C.]

## TABLE OF NEW CASES OF SICKNESS,

*Coming to the knowledge of the Medical Officer of Health, during Year ending December 31st, 1881, in the Urban Sanitary District of South Shields, classified according to Localities and Diseases.*

SANITARY DISTRICTS.	NAMES OF LOCALITIES.	NEW CASES OF SICKNESS, IN PERSONS BELONGING TO THE DISTRICT, DISTINGUISHING THOSE IN CHILDREN UNDER FIVE YEARS OF AGE.																		
		12	Small-pox 13	Measles. 14	Scarlatina. 15	Diphtheria. 16	Croup (not "spasmodic"). 17	Whooping Cough. 18	Continued Fevers.			Diarrhoea and Dysentery. 22	Cholera. 23	Rheumatic Fever. 24	Erysipelas. 25	Pyæmia. 26	Puerperal Fever. 27	Ague. 28	Bronchitis. 29	Phthisis. 30
									Typhus. 19	Enteric or Typhoid. 20	Other or Doubtful. 21									
	1	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
I.	{ Sub-division 1.....	Under 5	...	3	...	...	...	1	...	...	..	...	...	...	...	...	...	...	23	...
		5 upwds.	...	6	...	...	...	1	...	...	2	5	...	...	1	...	...	...	34	5
	{ Sub-division 2.....	Under 5	...	2	..	...	...	...	...	...	...	...	...	...	...	...	...	...	9	...
		5 upwds.	...	2	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	3
II.	{ Sub-division 1.....	Under 5	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
		5 upwds.	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	5	...
	{ Sub-division 2.....	Under 5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
		5 upwds.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
III.	{ Sub-division 1.....	Under 5	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20	...
		5 upwds.	...	1	...	...	...	...	...	...	...	3	...	...	1	...	...	...	1	1
		5 upwds.	...	2	...	...	...	...	1	...	...	1	...	1	2	...	...	...	3	...
	{ Sub-division 3.....	Under 5	...	2	...	...	...	...	...	...	...	2	...	...	...	...	...	...	17	...
		5 upwds.	...	2	...	...	...	...	2	...	...	...	...	...	1	...	...	...	5	2
IV.	{ Sub-division 1.....	Under 5	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
		5 upwds.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...
	{ Sub-division 2.....	Under 5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
		5 upwds.	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	3
V.	{ Sub-division 1.....	Under 5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
		5 upwds.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
	{ Sub-division 2.....	Under 5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
		5 upwds.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals.....		Under 5	...	12	...	...	...	1	...	...	...	2	...	...	...	...	...	...	71	...
		5 upwds.	...	13	...	...	...	1	3	...	2	11	...	1	8	...	...	...	53	14





REPORT  
ON THE  
SANITARY RELATIONS  
OF THE  
GARDEN WALKS AREA,  
SOUTH SHIELDS.

BY  
A. CAMPBELL MUNRO, M.B., B.Sc., M.R.C.P.E.,  
MEDICAL OFFICER OF HEALTH.

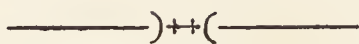


SOUTH SHIELDS :  
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MDCCCLXXII.



# R E P O R T . \*



In accordance with the request of the Committee I have duly inquired into the sanitary relations of the area known as “the Garden Walks,” which is bounded on the N.W. by the N.E. Railway, on the E. by the back of Eldon Street, and on the S. by Mr. Edward’s land.

The area under report—originally lowlying—has assumed a relatively much lower level, in consequence of the formation of the railway embankment on one side, the ground on which Eldon Street has been built having been made up to a high level on another side, and that belonging to Mr. Edwards having been elevated for building-purposes by the deposit of ballast on the third side. As the result of the alterations in the surrounding ground level the Garden Walks area has relatively sunk into an abrupt hollow.

The privy accommodation in this district is, for the most part, of a somewhat primitive description, consisting sometimes of a shed, a seat, and nothing more: in other cases regular privy-middens exist: in all the removal of refuse by the scavengers is a matter of difficulty, from the middens being inaccessible to carts and the walks sometimes being too narrow to admit of the passage of an ordinary wheelbarrow. A considerable part of the refuse however is utilized by being spread as manure on the garden ground.

My attention was particularly directed, in the first instance, to the drainage arrangements. I find that one of the Corporation sewers—diam. 3ft. 6in. by 2ft. 4in—runs down Reken Dyke Lane, passes under the railway, across the Garden Walks area, under Mr. Edwards’s made ground, to join at right-angles the sewer which passes down in a line with Reed Street to have its outfall at Readhead’s dock. The ground never having been properly laid out for building purposes, it is somewhat difficult to ascertain exactly which houses drain into this sewer, but it seems pretty certain that Watt’s brewery and the property known as the Willow Cottages, with the houses in their immediate vicinity, do so. But the houses east of that line appear all to be drained into a mere surface channel—open for most of its length, but covered

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\* Printed by order of the Sanitary Committee.



for convenience at intervals. This drain when first inspected was more or less choked up at various parts of its course and smelt very foully, and even when cleaned out it must be almost stagnant (and its contents consequently in a more or less putrid condition,) from the insufficiency of its fall; from its construction it is liable to be very frequently choked up. This channel has its origin apparently as a closed drain in Reken Dyke Lane; it formerly emerged from the Garden Walks area only to distribute itself in devious rills over the fields which Mr. Edwards has since filled in with ballast. Mr. Edwards has left the drainage of the Garden Walks themselves practically *in statu quo* by providing a twelve-inch drain as a continuation of the above mentioned channel; this twelve-inch pipe discharges at the west side of the Edwards embankment, and distributes the sewage (which has by this time by reason of the slowness of its flow and from the faulty construction of the drain considerably altered its normal composition,) into surface channels on Mr. Stevenson's ground, which ultimately reach a culvert under the railway embankment. There seems to be no attempt whatever at subsoil drainage of the district.

It is unnecessary for me to say that this drainage system is a most improper one, and that the sewage from the houses should have been led at once into the Corporation sewer as it passes through the Garden Walks; the presently existing surface drain being filled in all along its course. Provision ought also to be made for the drainage of the subsoil, without which the foundations of the houses must always be damp.

The introduction of a proper drainage system, however, can never place the district in such a condition as would be thoroughly satisfactory from a sanitary point of view. Its situation in such a hollow encourages that stagnation of the atmosphere which is so favourable to the development of the germs of putrefaction and of disease,\* and deprives it of that wholesome perflating action of the wind which serves to dilute at once any emanations which may arise in a district whether from men, animals, or decaying vegetation, and carries them off into the general body of the atmosphere—there to be oxidized and rendered innocuous. Further, the air in such a locality is necessarily colder and damper than in one standing on a higher level. Cold air being heavier than warm air will tend to flow down and occupy the hollow; and the lower temperature implies greater dampness of the atmosphere, for as you are aware the capacity of the air for moisture decreases as the temperature falls; in other words, the quantity of moisture present in the air of a hot summer's day which one feels quite dry and pleasant may be

---

\* Prof. Tyndall found in the course of some experiments with flasks containing organic infusions that the germs of putrefaction developed much more rapidly in flasks placed in the sheltered corners of a room than in those placed where there were currents of air.

sufficient if the temperature were suddenly lowered a few degrees to envelope one in a thick mist; in this way a climate which at the higher temperature might appear quite dry and comfortable would, without any moisture added to it, at the lower temperature be intolerably damp. I do not say that the difference of level in the case in point is sufficient to produce very decided results of this sort, but there can be no doubt that it must give rise to more or less appreciable effects in the case of susceptible subjects such as delicate adults and children, although it may not yet, among so small a population, have told upon the death-rate. Further there must be a tendency for the surface water from the surrounding higher ground to flow down into the hollow and thus add to the dampness of the already insufficiently drained soil.

The *radical* cure for the sanitary deficiencies of the district would be the pulling down of all the cottages in it and the raising of the area to the same level as the surrounding parts. The houses themselves are not in such a condition as to enable me to pronounce them unfit for habitation if they were properly drained, nor indeed are they for the most part insanitary in themselves; the radical defect is the lowness of the site common to all of them. It is for the Committee to decide whether it is expedient to insist on the introduction of a proper system of drainage which would be merely a palliative and which is likely to be rendered useless in the natural course of events by the elevation of the site at some future time, or whether they see any way to the radical cure just suggested.

Any report as to the sanitary condition of a district would be incomplete which did not take cognizance of such *sanitary statistics* as exist with regard to it, and I have in conclusion to report to the Committee the interesting fact that in spite of those sanitary defects which undoubtedly exist in this locality, it would appear to have a lower mortality rate than the Borough as a whole. The population on this area was estimated by Dr. Spear in 1875 at 81; I have ascertained by house to house visitation that it now amounts to 140; calculating the death-rate on the mean of these numbers, 110·5, I find from the annual reports that in the six years ending 1880 the mean death-rate for the Borough generally was 20·7, while in the Garden Walks district it was 19·6, leaving a balance to the credit of this district of 1·1 per 1000. Now, I think

is of importance that we should endeavour to ascertain the real significance of these numbers. And first of all I would remark that exception might be taken to any conclusions drawn from them on the ground of the smallness of the figures at our disposal. The Baconian method is undoubtedly the most profitable mode of investigation, but it is equally unquestionably of little utility when the number of facts at the disposal of the investigator is small, and may indeed betray the inquirer into very serious fallacies. Waiving this objection, however, I would point out that these figures do not bear out the



conclusion which might be hastily drawn from them—that they nullify the criticism which I have made on the sanitary condition of the district. They merely tend to show that the district under consideration is healthier than the Borough as a whole. They do not in the least prove that it might not be made healthier still by improved hygienic arrangements. And further, it must be remembered that it is only recently—since this area has been banked in on the west side by Mr. Edwards that its situation has become so objectionable, and it must be admitted that environed as it now is on every side by higher ground the chances of the continuance of so low a rate of mortality in the future are materially diminished. It is interesting however to inquire how in spite of these more or less serious defects in the way of drainage, lowered temperature, &c., this lower death-rate has been maintained. I have no doubt the key to the problem is to be found in the absence of those insanitary influences which are involved in the term *surface-crowding*—in other words, in high density of population. The garden plots interspersed between the cottages impart a pleasantly rural aspect to the district, and in this area of 5·6 acres the mean population for the years 1874–80 amounted, as I have said, only to 110—or at the rate of 19·6 persons per acre, and these are pretty uniformly distributed over the surface. In an adjoining district known to the sanitary authorities as District III., sub-division 3, the rate was estimated as far back as 1875 at 181·8 per acre, in other words the density of the population was nine times as great as in the Garden Walk area, and it must have risen very considerably since 1875. If certain areas occupied by various large public works in the town, which do not in the least contribute to the amelioration of the sanitary conditions of the Borough, were cut out, I have no doubt that the density rate would be much higher. I shall not trespass upon the time of the Committee by entering at present into a discussion as to the ways in which density of the population affects the death-rate of a town; it is well known that a pretty constant ratio exists between the two.

I should like, however, to add to what I have said as to the sanitary conditions of the district the remark, that while under ordinary circumstances a low death-rate may be maintained with such relations, yet if the germs of a specific disease once find an entrance to the district, most of the conditions for their rapid propagation are already present, and the disease has every chance of assuming an epidemic form; in this way the death-rate of one year might be sufficient to run up the mean death-rate of a series of years.

A. CAMPBELL MUNRO,  
Medical Officer of Health.

*South Shields,*  
*Sept. 25th, 1882.*



REPORT  
ON THE  
CHEMICAL WORKS  
OF SOUTH SHIELDS  
IN THEIR  
RELATION TO THE PUBLIC HEALTH.

BY  
A. CAMPBELL MUNRO,

M.B. (Edin.), B.Sc., M.R.C.P.E., C.M.,

MEDICAL OFFICER OF HEALTH FOR THE BOROUGH.

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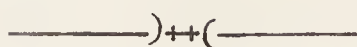
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MDCCCLXXXIII.



# REPORT.



Under the convenient designation of Chemical Works, I include the Alkali Works, Glass Works, and Gas Works of the district, in all of which more or less definite chemical processes are carried on, and from all of which products of a more or less definite chemical composition are liable to escape into the atmosphere. In accordance with the desire of the Committee, I have repeatedly visited these works for the purpose of informing myself as to the processes carried on in them,\* and have endeavoured to differentiate their effects on the health of the town by means of the sanitary statistics of the past. As the result of my inquiries, I have to submit the following Report:—

## I.—THE ALKALI WORKS.

Of these, as you are aware, there are three within the district—those of the Tyne Alkali Co., the Jarrow Alkali Co., and the St. Bede Alkali Co.

In the works of the Tyne Alkali Co. the manufacture of Carbonate of Soda, and Chlorate of Potash is carried on.

In the Jarrow Alkali Works Carbonate of Soda, Bi-carbonate of Soda, and Caustic Soda are produced.

At the St. Bede's Co.'s works, Carbonate of Soda and Bleaching Powder are the final results of the operations carried on.

In all of these works the manufacture of sulphuric acid is carried on as an intermediate step to the production of the carbonate of soda or "Soda-Ash" as it is called. The first step towards the manufacture of sulphuric acid is, as you know, the roasting of cuprous pyrites—bi-sulphide of iron, with a small admixture of copper, and containing about 49 per cent. of sulphur: the sulphur burning, that is, combining with oxygen—forms sulphurous acid gas ( $\text{SO}_2$ ), which passing over into the lead chambers is thus oxidized by means of nitric acid vapour and steam into sulphuric acid ( $\text{H}_2\text{OSO}_3$  or  $\text{H}_2\text{SO}_4$ ). The nitric acid is recovered and the sulphuric acid concentrated, by means which I need not now describe.

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\* I have in this connection to acknowledge my indebtedness to the very lucid and interesting Reports on Effluvium Nuisances by Dr. Ballard, and to the standard work of Dr. Lunge on "Alkali."



In this first process an escape of gas productive of annoyance outside may occur at two or three points. In the first place from the pyrites burners: here an escape is possible through chinks and cracks which form if the brick-work is allowed to become dilapidated, or from crevices about the doors; and to a greater extent (from insufficiency of draught) from the doors themselves when they are being charged. I need hardly remark as to the necessity of maintaining the plant in good repair. Various opinions prevail as to the relative advantages of hinged and sliding doors: in either case care must be taken that any chinks which may arise are well luted. The regulation of the draught is a matter of some delicacy; in the interest of the manufacturer too great a draught is undesirable as tending unduly to dilute the gas passing over and for other reasons: while if too much restricted the gas tends to escape through imperfectly fitting doors or other accidental crevices. To prevent the nuisance of escape from the feeding doors which may occur even when the chambers are working well, it is only necessary to close all the ash-pit doors before the door of the furnace to be charged is opened: in this way the necessary supply of air being forced to enter through the only open door any reflux of gas is rendered impossible. The escape of gas from the "nitre-pot" in which the nitric acid is generated may be prevented by the same means. It is obvious that "constant watchfulness is requisite in respect of the leaden chambers" in which the conversion of the  $\text{S O}_2$  into the  $\text{S O}_3$  takes place "and in making necessary repairs." The nuisance arising from imperfect condensation of the sulphuric and nitric acid produced is entirely avoidable by the proper working of the Lussac and Glover towers. The requirement of the Alkali Act is that "the acid gases of sulphur and nitrogen escaping in each cubic foot of air, smoke or gases from the chimney shall not exceed what is equivalent to four grains of sulphuric anhydride."\*

It is in the next stage of the process—the conversion of Chloride of Soda (common salt) into sulphate of soda (salt cake)—that the most obnoxious escape of gas is apt to occur. In this operation sulphuric acid is run in among the salt which is placed in the decomposing pans, and the mixture is

\* The condensation of these acid gases seems to be efficiently carried out in the borough. I am indebted to the kindness of Mr. Jackson, H.M. Alkali Inspector for the Tyne district, for the results of the analyses made by him during the three months ending October 31st, 1882. The subjoined table shows the mean of these analyses: on no occasion was the Government limit—which gives rather a liberal allowance, however,—nearly reached.

Total Acids of Sulphur and Nitrogen as $\text{S O}_3$ , in Chamber outlets, in grains.					
Tyne Alk. Co.	Jarrow Alk. Co.		St. Bede Alk. Co.		Requirement of the Alkali Act— not more than
	No. 1.	No. 2.	No. 1.	No. 2.	
1·47	·28	1·06	1·39	1·55	4·00

exposed to a strong heat: the sulphuric acid acting on the salt produces sulphate of soda, and hydrochloric acid gas is given off [ $2\text{Na Cl} + \text{H}_2\text{S O}_4 = \text{Na}_2\text{S O}_4 + 2\text{H Cl}$ ] and is conveyed in flues to the condensers. The conversion of the salt into salt cake is completed in reverberatory furnaces called “roasters” which are continuous with the decomposing pans, and the hydrochloric acid given off at this stage is also led away to the condensers. These consist of towers 40 to 60 feet high, packed with coke or brick, into the top of which water is led: the water falling over the pieces of coke or brick is broken up into innumerable films, and thus a very large surface for the absorption of the hydrochloric acid gas is afforded.\* In most cases during or shortly after raking up the fresh batch of mixed salt and acid—when the evolution of gas is most vehement, and also when shoving the batch from the pan into the furnace, a certain escape of hydrochloric acid is apt to take place through the doors or through crevices in the brickwork, especially if the draught through the condensers is insufficient. But the chief escape of gas occurs when—the roasting being completed—the salt-cake is raked out into (iron) barrows, and is being wheeled away to the storehouse. I find that the nuisance arising at this stage is often attributed by the public outside these works to chlorine. Some escape of this sort always takes place when the batches are being drawn, but it is sometimes excessive: it is greatest when the charge is drawn too early, and before it has been sufficiently roasted. If what is called a “strong” salt cake has been formed, the vapours are most sulphuric acid or anhydride, if “a weak” salt cake—then hydrochloric acid. *The escape of acid gas at this stage I believe to be the most grievous nuisance associated with Alkali Works.* The nuisance might be largely mitigated by either of two methods which have been adopted in some works, though not in any of the works in this district. The first is the erection of light vapour hoods of wood or cast iron over the doors and dampers, connected by fire-clay pipes with a well-drawing chimney: “the use of such hoods affords time for an efficient use of the next proceeding which ought always to be adopted, namely, the covering of the hot and freshly-drawn salt cake with cold salt cake patted down upon it before the barrow is wheeled away. Workmen often neglect this precaution on account of the trouble of bringing cold

\* The subjoined table, which gives the mean of the analyses carried out by Mr. Jackson during the three months ending October 31st, 1882, shows that the hydrochloric acid escaping condensation in the Alkali works of this district has been well within the limit of the Alkali Act.

H Cl per cubic foot in Gases escaping from Chimney, in grains.						
Tyne Alk. Co.	Jarrow Alk. Co.		St. Bede Alk. Co.			Requirement of the Alkali Act— not more than
	No. 1.	No. 2.	No. 1.	No. 2.	No. 3.	
·084	·145	·041	·149	·112	·113	·200



salt cake to the mouth of the furnaces.” And, indeed, I have not observed this precaution being taken at any of the works in town. But perhaps a more efficient method is that adopted at the Netham works, where “the charge from the roasters is drawn through an aperture provided in the floor of the roaster into a space below, closed in front by an iron plate with an aperture in it for the admission of air. The fresh salt cake is left here to cool for half an hour, the acid vapours passing by a flue from the chambers to the chimney,” or better still to a condenser if practicable. In any case it is necessary that care should be taken that batches are not too soon drawn.

In the Jarrow Company's Works part of the salt cake produced is manufactured by means of Hargreave's process. In this mode of operation there is no intermediate manufacture of sulphuric acid, the sulphurous acid gas from the pyrites-burners being led at once, together with steam and a certain proportion of air, through a series of heated cylinders containing moulded lumps of common salt  $[2\text{NaCl} + \text{SO}_2 + \text{H}_2\text{O} + \text{O} = \text{Na}_2\text{SO}_4 + 2\text{HCl}]$ . The gases are drawn through for ten days or so, then shut off for a night; air is then drawn through the cylinders to remove any unabsorbed gas. The advantages claimed for this process are “the steady evolution and easy condensation of the hydrochloric acid, comparative freedom from nuisance of escaping gas since the lead chambers and decomposing pans and furnaces, always wanting repairs and difficult to keep gas-tight, are replaced by gas-tight cylinders into which gas is aspirated and from which it thus cannot leak out.”\* It is to be hoped that this process may turn out as profitable commercially as it is desirable hygienically, and that it may soon become general in Alkali works.

In the further processes of the conversion of Sulphate of Soda into “black-ash,” in which the Sulphate of Soda is strongly heated, together with crushed coal and limestone or chalk  $[\text{Na}_2\text{SO}_4 + \text{C}_2 + \text{CaCO}_3 = \text{Na}_2\text{CO}_3 + \text{CaS} + 2\text{CO}_2]$  and the “lixiviation” or dissolving out from the black-ash of the Carbonate of Soda thus formed, no appreciably obnoxious emanation is given off.

In the Jarrow Co.'s works the further processes carried on are the manufacture of Caustic Soda by the action of slaked lime in Carbonate of Soda in solution  $[\text{Na}_2\text{CO}_3 + \text{CaH}_2\text{O}_2 = 2\text{NaHO} + \text{CaCO}_3]$ , and Bi-carbonate of Soda by the action of carbonic acid gas, in closed vessels in crystalized Carbonate of Soda  $[\text{Na}_2\text{CO}_3 + \text{H}_2\text{CO}_3 = 2\text{NaHCO}_3]$ : in these processes no nuisance arises.

In the Tyne Co.'s works the only manufacturing process carried on in addition to that of Carbonate of Soda, is that of Chlorate of Potash. The chlorine required for the purposes of the manufacturers is generated by the

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\* Dr. Lunge on “Alkali.”



action of manganese di-oxide on hydrochloric acid in closed stills made of slabs of siliceous stone cemented and bolted together. The gas is led from the stills by means of stoneware pipes luted together, and is passed through three vessels in succession over the surface of a mixture of milk of lime and chloride of potassium solution, kept constantly agitated by means of machinery: the openings into these vessels are water trapped, having a "seal" of six inches. Provided the apparatus is in good working order and the regular generation of the gas is properly attended to, it is impossible that the chlorine should escape absorption in one or other of these vessels, the contents of all three never being saturated at once, but to meet such a contingency a pipe is led from the last vessel of the series to the old chloride of lime chamber which is now only used as a reserve condenser for the gas. So little chlorine really passes into this chamber that when the lime is changed, perhaps once in two months, it has hardly any perceptible odour of chlorine. The mixed solution of chlorate of calcium and chloride of potassium is run into shallow evaporating pans in which chlorate of potassium crystalizes out. As a rough and ready method of preventing the escape of any appreciable quantity of chlorine from the saturated solution, before it is run into the crystallizing pans a few buckets of tank waste liquor are added to it in order to neutralize any excess of chlorine. The manganese di-oxide is recovered by means of the Weldon or "regenerative" process, in which the proto-chloride of manganese left as a residue from the chlorine-generating operation is mixed with excess of milk of lime, air is blown through the mixture, and steam sufficient to raise the temperature to  $140^{\circ}\text{F}$ . is passed in, the manganese di-oxide precipitate forming the "manganese mud" which is again used for the generation of more chlorine. In these processes there ought to be little or no escape of chlorine, unless through gross carelessness on the part of the workmen. As these works, from their unfortunate position in the heart of the town, are those which are most obnoxious to the community and most complained about, I think it right to remark here that several changes conducive to the mitigation of previously existing nuisances have been made since Dr. Spear reported on the subject in 1875—in the supersession of the chloride of lime production by that of chlorate of potash, the erection of additional hydrochloric acid condensers, and the deodorization of their tank-waste drainage by a method which involves a yearly expenditure of about a hundred pounds. While doing justice, however, to the efforts of the managers to minimize the offence to the public, I feel bound to say that I think it was most unfortunate that the re-establishment of Alkali works on such a site was ever sanctioned.

In the St. Bede Co.'s works beside the manufacture of Carbonate of Soda, that of Bleaching Powder or "Chloride of Lime" is carried on. The chlorine required is generated and the manganese recovered by similar processes to those adopted in the Tyne Co.'s works. The chlorine gas obtained by the



action of manganese di-oxide on hydrochloric acid is led by means of well-luted stoneware pipes into lead chambers about  $6\frac{1}{2}$  feet high, on the floor of which hydrate of lime—slaked lime—has been laid to a depth of about six inches, the doors being carefully closed and luted. After 36 to 48 hours exposure to the gas usually, the doors are opened to allow of the lime being turned ; the doors being again closed the gas is passed in for 24 hours or as much longer as may be deemed necessary for the saturation of the lime. The gas is then turned off, and after an interval of 24 hours, or often somewhat longer, to permit of complete saturation, the doors are opened and are left open for a short time to allow of the dilution of the unabsorbed gas. The chambers are then entered by the workmen (wearing many-ply flannel “mufflers” in order in some degree to protect themselves from the gas), and the chloride of lime is shovelled into casks. In these processes there is of course a possibility of accidental leakages from the lead chambers, but these never exist to such an extent, I believe, as to give rise to a nuisance appreciable outside the works. An appreciable nuisance, however, may arise when the lead chambers are opened for the purpose of turning the lime or discharging the bleaching powder. The occupation of the men who have to enter these chambers and pack the powder must be pronounced decidedly unhealthy. The establishment of such a process as the Deacon (in which the saturation of the lime is effected by means which are not productive of nuisance outside of the works and in connection with which there are no chambers to be entered by the workmen) as a profitable commercial undertaking is much to be desired, more especially in the interest of the employés in such works. In some works, however, the nuisance is materially mitigated by means of appliances for drawing off the unabsorbed gas.

In connection with the subject of Alkali works it is necessary that I should say something of the “tank-waste” nuisance. What is known as tank-waste is the residue of the “black-ash” from which the carbonate of soda has been dissolved out. As the Committee are aware all the tank-waste produced in the district is now and has for some time past been carried out to sea in “hoppers” and discharged there. This mode of disposal is thoroughly satisfactory sanitarily, but is somewhat expensive and—from the abstract point of view at least—decidedly wasteful, in that all the sulphur which enters the works is thrown away in the waste. The community, however, especially at the west end of the district, have to suffer to a very serious extent for the sins of omission (on the part of the Sanitary Authority) and commission (on the part of the Alkali manufacturers) of preceding generations, in the disgusting odour of sulphuretted hydrogen, which arises from the drainage of the old tank-waste deposits at Jarrow and East Jarrow and permeates the atmosphere of these localities. Dr. Ballard remarks in his Report on Effluvium Nuisances, (in connection with which inquiry he must have had considerable



experience of evil odours), that he “never had the misfortune of such an exposure to sulphuretted hydrogen as on crossing the bridge over the river close to St. Bede’s Church (Jarrow): it was sickening!” The drainage of the large waste deposits at Jarrow passes, as you are aware, into a tidal stream known as the Don: the sea water with each rise of the tide washes the banks of this stream and the base of the waste-heaps, thus constantly leaving as it recedes a fresh surface exposed to the air. The Don is perfectly turbid with deposited sulphur and gives off in its course to the river (during which it passes under the highway) a copious exhalation of sulphuretted hydrogen. This stream, however, does not pass into the Tyne at the nearest point, but pursues its sluggish course round the river side of the St. Bede works, all this time discharging more or less sulphuretted hydrogen. Opposite East Jarrow it receives a small tributary of a like offensive nature which brings down the drainage from a smaller deposit of waste at East Jarrow, and which also passes under the highway. The stream continues to flow eastward till reaches the west end of Tyne Dock where it enters a channel which also discharges the contents of one of the large town sewers. The tedious passage of the waste drainage is, of course, periodically interrupted at high tide, and the rise of the tide seems to force back some of the drainage carried down by the Don into the town sewer which discharges into the same channel, giving rise occasionally to a nuisance along its course.\*

If the nuisance from these tank-waste deposits at East Jarrow and Jarrow were likely to be merely of a temporary character, the Sanitary Authority might view the occurrence with equanimity, but there is no prospect of any material diminution of the nuisance for the next 30 or 40 years unless some active steps are taken in the matter. I have, therefore, thought it my duty in accordance with the provisions of the Alkali Act to direct the attention of the Chief Inspector of Alkali Works to the nuisance arising from these deposits. He assures me in reply that he is not unmindful of the matter, that he has set on foot a series of experimental researches at Widnes, where also such deposits give rise to considerable nuisance, and that when these trials are brought to a satisfactory conclusion he intends urging on the question elsewhere. The additional complication of the tidal wash exists at Jarrow, and unless this is prevented by means of an embankment it is difficult to see how any satisfactory mitigation of the nuisance can be attained.

It may be necessary to explain how the deposit of tank-waste in a district gives rise to offensive emanations. As discharged from Alkali works it consists mainly of sulphide, carbonate, and hydrate of lime—together with small quantities of coal, carbonate of soda, silica, iron, and alumina. Exposed for

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\* I may remark here that this is not an unmitigated evil, as it serves to give useful indications of defective trapping of house-drains. I should, however, recommend the replacement of the flap-valve which formerly existed at the outfall of this sewer.



a time to the action of the atmosphere oxidation of the sulphide of calcium goes on, and hyposulphite, sulph-hydrate, and polysulphides are formed, together with the corresponding sodium compounds. Part of the sulphur separates out, burns, and forms sulphurous and sulphuric acids—these, with the carbonic acid of the air, form sulphate and carbonate of lime, the former reacting on the small quantity of carbonate of soda present produces sulphate of soda. Finally, there ought to be nothing left but carbonate of lime, sulphate of lime, sulphate of soda, calcium and aluminum silicate, ferric oxide, coal, and some indifferent and harmless matters. Even after 30 or 40 years, however, unoxidized sulphur is still found in the interior of waste heaps. During this slow process of oxidation the rain washing through the waste-heaps, or, it may be, springs rising from below, carry away in solution calcium hyposulphite and the soluble sulphides of lime, in the form of a greenish-yellow drainage liquor. An analysis of such drainage liquor given by Dr. Ballard showed in 100 parts—calc. sulph-hydrate 76·3 parts, calc. hyposulphite 18·2 parts, and calc. polysulphides 5·5 parts. The sulph-hydrate ( $\text{Ca H S}$ ) and polysulphides ( $\text{Ca S}_x$ ) acted upon as they flow by the carbonic acid of the air and soil give off sulphuretted hydrogen—the hypo-sulphite acted upon in the same way will give off sulphurous acid (which will neutralise a *small* proportion of the sulphuretted hydrogen formed) and deposit sulphur, this sulphur with the carbonate of lime also formed *in transitu* constitutes the turbidity of the liquid. The sulphuretted hydrogen smell is worst in rainy weather from the carbonic acid of the air being washed down by the rain, and if the drainage is allowed to flow into a sewer the sulphuretted hydrogen will be more plentifully disengaged from the excessive amount of carbonic acid present in sewer gas. Of course, if the waste drainage comes into contact with acid drainage the evolution of sulphuretted hydrogen is still more copious, and the nuisance becomes still more aggravated.

A certain amount of tank-waste liquor drains away from an old deposit on the ground of the Tyne Alkali Company, and was at one time run directly into one of the town sewers, creating a nuisance which was much complained of all along its course. To obviate this Dr. Lunge, at that time manager of these works, devised a plan by which the drainage was intercepted and directed into a series of ponds together with the refuse from the Weldon “settlers”—this consisting chiefly of hydrate of iron, carbonate of lime, and some proto-chloride of manganese. The mud in the ponds is from time to time stirred up or shovelled out on the banks—to promote oxidation. In the course of these operations some such process as this goes on: the hydrate of iron and proto-chloride of manganese acting on the sulphides of lime form sulphides of iron and manganese, and hydrate of lime. The hydrate of lime acted upon by the carbonic acid of the air forms carbonate of lime which with that introduced in the refuse, settles to the bottom: the sulphides of iron and

manganese are oxidized more or less completely by the action of the air, depositing sulphur—which settles to the bottom, and reforming the oxides which are then ready to decompose more sulphide of lime. The supernatant liquid—at least when the process is thoroughly carried out—flows away inodorous and innocuous. A certain quantity of sulphate of lime is found in the effluent liquor: this is believed by Dr. Ballard to be formed by oxidation—through the intermediate formation of sulphate of manganese: it can, however, I think be accounted for by the proportion of sulphuric acid which is practically found to be carried over from the decomposing pans along with hydrochloric acid—this acid being subsequently used in the Weldon stills.

An insignificant quantity of waste drainage issues from a tank-waste deposit on the ground of the deposit in the ground of the Jarrow Co., but does not enter the Corporation sewers, being carried off through a drain\* provided by the N.E. Railway Co., and discharged at the entrance to Tyne Dock, separately from the acid drainage from the same works.

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## II.—GLASS WORKS.

Before proceeding to consider the effects upon the public health of the presence in the district of the Alkali Works, whose operations I have just described, it will be convenient to give some outline of the processes carried on in the Glass Works, as they materially aid in the deterioration of the atmosphere by the evolution of similar acid gases.

Shortly after entering office here, my attention was directed to a nuisance in connection with the Tyne Plate Glass Works, consisting of a “gassy” smell, disagreeably appreciable especially in the Market Place, and more particularly when the wind was from the south-west. This was attributed entirely to the “gas producers” in use in these works, and a somewhat unfounded prejudice against these contrivances seems to have sprung up in the public mind. I should like, with your permission, to clear up the misapprehension which exists on the subject. I do not think that any nuisance arising in this department prevails to such an extent as to be appreciable in the Market Place, the stoke-holes of the gas-producers being situated by the river side and having the whole body of the works intervening and tending to dissipate any gases escaping there ere they can reach the centre of the town. I am of opinion that in the public interest the use of such gas-furnaces, conducted with proper precautions, should be encouraged as tending to hasten the

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\* This drain was recently choked up, giving rise to an eruption of the tank-waste liquor in the public road.



advent of the Siemens millenium of smokelessness—an era the blessings of which would be peculiarly appreciated in South Shields.\* Such gas-furnaces have had their origin in the consideration that in ordinary furnaces the fuel or combustible matter and the atmospheric air are not brought into such relations as to produce anything like complete combustion of the fuel and the corresponding calorific effect, and in this way smoke and unconsumed gas pass off into the atmosphere. The essential feature of such “gas-producers” as are in use in the Plate Glass Works is, as you are aware, the generation of crude coal gas in a set of what may be called “retort-furnaces,” for consumption when lead to the point at which heat is required, where it is met by a current of (generally) heated atmospheric air. In these gazogenes the fuel which is to produce the gas is placed—not, as is the case in Gas Works which supply gas for ordinary illuminating purposes, in closed retorts heated by separate furnaces—but in the furnace itself, a limited supply of air being admitted, sufficient only to produce the heat required for distilling the gas from the super-incumbent fuel. In the lower part of the furnace, to which the air is admitted, by the combustion there produced carbonic acid gas ( $\text{C O}_2$ ) is formed; this rising through the mass of red-hot coal (mainly carbon) overhead, is reduced, that is, has part of its oxygen taken from it, and forms carbonic oxide gas ( $\text{C O}$ ); this is led to the glass-fusing furnace of which it forms the fuel, and there—in admixture with atmospheric air previously heated by the Siemens regenerative process—is burnt into carbonic acid, thereby yielding the requisite heat. In the newer range of furnaces—known as Wilson’s Patent—a jet of steam is also introduced at the lower part of the furnace, this is decomposed in the interior, and the gas produced in these constitutes what is described as a “richer” fuel, that is, one of greater calorific power.

A nuisance to a limited extent does arise in connection with the operation of these gas-producers: the gazogenes are charged from above by means of “bell-mouths” or “boxes” as they are variously called,—these are separated from the body of the furnace by, at least theoretically, gas-tight valves, kept closed by means of a counter-poise. A charge of fuel is introduced into each box every half-hour or so—the counter-poise is raised—and the charge descends into the furnace: of course, the gas rushes out till such time as the valve is again closed, and if the stoker is careless or inexperienced it can be under-

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\* In this connection the following quotation is of interest :—“Professor Roberts has calculated that the soot in the pall hanging over London on a winter’s day amounts to fifty tons; and that the carbonic oxide, a poisonous compound arising from the imperfect combustion of coal, may be taken as at least five times that amount. The fine dust resulting from the imperfect combustion of coal is mainly instrumental in the formation of fog, each particle of solid matter attracting to itself aqueous vapour: these globules of fog are rendered particularly tenacious and disagreeable by the presence of tar-vapour. another result of imperfect combustion of raw fuel.”

*Dr. Siemen’s Presidential Address, Brit. Assoc., 1881.*



stood that a considerable escape of gas may take place at such times. In a smaller degree an escape of gas takes place each time the gas-producer is stirred up—the stirring-rods being introduced from above through holes placed around the charging orifices. I have to remind you that the gas which is here spoken of as escaping consists mainly of carbonic oxide—a gas which when inhaled produces dangerous effects on the animal economy. One-half per cent. in the air breathed would produce poisonous symptoms, and anything over one per cent. would be pretty rapidly fatal. Of course, when largely diluted, as the escape here taking place soon becomes, the results are not nearly so evident, but even then it must be more or less prejudicial to the workmen employed about these furnaces. Speaking of these gazogenes a classical writer\* says:—“From the exceedingly poisonous nature of carbonic oxide it is of the utmost importance to prevent the escape of unburnt gas; and if this cannot be prevented the escape must be fired when the charging-hole is opened. This is regularly done in blast-furnaces working with gas-collecting flues; and even the native iron-smelters of India in starting their small furnaces with stacks only a few feet high, observe the same precaution.”

As a practical remedy for the nuisance arising here I would suggest the addition of a gas-tight lid over the mouth of each charging box, and the leading of a gas-escape-pipe from each charging box to the furnaces. Each time a charge was introduced into the box the lid would be closed ere the valve communicating with the body of the gas-producer was opened—when this was opened and the gas had rushed up into the box it would be at once sucked off into the furnace where it would be burnt. An automatic arrangement might easily be attached by which the aperture of the gas-escape-pipe would just be uncovered as the lid was shut: in this way there would be no unnecessary admission of cold air into the furnace. With respect to the stirring-holes I would remark that if introduced into the lower part of the furnace they would be equally effective, and their use would not be attended by any escape of gas.

As I have already indicated, however, the nuisance attributed by the public to the “gas-producers” arises in another fashion: it occurs in the process of glass-casting. Glass is, as you are aware, “a mixture of insoluble silicates produced by the fusion together of materials, the precise nature and proportions of which vary with the kind of glass to be made, and to some extent also in different works making the same kind of glass.” In the plate-glass works in this country the ingredients used are sand, lime, sulphate of soda, “cullet” (broken glass), and a little arsenious acid (“white arsenic”).† The mixture

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\* Bauerman, Art. Furnaces, Encyc. Brit.

† The composition for a “mixture” for French plate-glass-making is given as—white quartose sand 100 parts, carbonate of soda 33·3 parts, slaked lime 14·3, manganese dioxide 0·15 parts, “cullet” 100 parts.



is exposed for the purpose of fusion to the very high temperature of the furnace, the products of the combustion of the fuel and gases—consisting mainly of sulphuric acid from the sulphate of soda—given off from the cast, passing off together and being led through the flues of the Siemen's Regenerator, are discharged into the atmosphere in the case of these works from a comparatively low chimney. The Tyne Plate Glass Co. have declined to furnish me with information as to the quantities of the various ingredients used in their works on the ground that these are trade secrets. I am therefore unable to inform the Committee with certainty as to the extent to which these works contribute to the contamination of the atmosphere. But supposing—a fair enough guess for works of the size of these—that 5 tons of sulphate of soda were used per diem, that would imply a daily discharge of 2 tons, 16 cwt. of sulphuric anhydride ( $\text{SO}_3$ ), or 3 tons, 9 cwt. of mono-hydrated sulphuric acid ( $\text{H}_2\text{SO}_4$ ).\* The usual proportion of arsenic used in plate-glass works is, I find, about 5lbs. to the ton of sulphate of soda, which would imply, on the basis above assumed, the daily use in these works of a quantity amounting to 25lbs. It is possible that a proportion of the arsenic remains as a constituent of the glass in the form of a double silicate, but from the volatility of the arsenic compounds in general we may fairly assume that at the temperature of these furnaces the greater part passes off into the atmosphere. The quantity is not large from the *avordupois* point of view, but when we recollect that two grains of arsenic may prove a fatal dose even for an adult, and that in very much smaller doses continued for a time are sufficient to cause symptoms of chronic poisoning, the volatilization of even this quantity of arsenic in the centre of the town cannot be regarded without apprehension by the Sanitary Authority. The evolution of acid fumes other than those which result from the combustion of coal would not occur if carbonate of soda were used instead of the sulphate: the sulphate is however cheaper, and it is asserted—probably with perfect truth—that it would be impossible to maintain the competition with foreign manufacturers if the glass-founders in this country were compelled to use the carbonate. Assuming then that the use of the sulphate in glassmaking is a commercial necessity, the first expedient which suggests itself for the abatement of the nuisance is the condensation of the acid gas evolved. Schott, indeed, has proposed to utilize the acid given off in making glass for vitrol-making, the gas to be made richer in sulphur by employing in the glass-mixture sulphate of lime (gypsum) instead of limestone. Dr. Lunge remarks, that “it is doubtful if this is practicable, since such diluted gas (mixed with a great deal of  $\text{CO}_2$ ) has not yet been utilized.” The main difficulty, however, arises out of the high temperature at which the fumes reach the chimney. No method appears yet to have been

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\* From the “reducing”—that is, deoxidizing—action of the furnace the sulphuric acid appears to be partly decomposed and given off in the form of sulphurous acid.

devised by which sufficient cooling of the gases to effect their condensation can be attained without undue interference with the draught of the furnaces. Under the circumstances the only remedy which suggests itself in connection with the discharge of the acid fumes, is a palliative one—that they should be discharged from a chimney-stalk of such a height as will secure their thorough diffusion and attenuation before they descend upon the surrounding district. With respect to the arsenical nuisance, however, the case is different: the arsenious acid appears to be used merely as an oxidizing or bleaching agent; in many places manganese dioxide, or nitrate of potash, is used instead—the use of these substances would not be productive of nuisance, and I think it is a matter for consideration whether the substitution of one or other of these should not be insisted upon in the case of works situated in populous districts.

A further evolution of sulphuric acid takes place at the Polishing Works of the Tyne Plate Glass Co. There crystallized sulphate of iron (copperas) is roasted for the purpose of furnishing the oxide of iron (rouge) used on the polishing tables. In this process first the water of crystallization of the sulphate is driven off, and then mono-hydrated sulphuric acid. The quantity of copperas used is probably a little over a ton per week. The acid gas is discharged from a low chimney, at about the level of the public road (Station Bank). There would be no physical difficulty in condensing the fumes from this process.

Some nuisance arises from the discharge of smoke and imperfectly burnt gas, by the rather low chimneys of the annealing kilns in the Glass-works. This would be considerably ameliorated by the flues being led to a high chimney stalk, or might be entirely abolished were it found practicable to connect all the kilns with the gas-producers. In a town, however, where so much smoke and imperfectly consumed gases are given off—from brick-kilns and even from furnaces which might be wrought in a manner productive of little nuisance, it is perhaps invidious to particularize these Glass Works.

In the Tyne Flint Glass Works of Messrs. Moore & Co. articles for table use principally are manufactured. Mr. Moore declines to furnish me with precise information as to the constituents used in the production of glass in these works on the same grounds as the declinature of the Tyne Plate Glass Co. was based, but he informs me that—as in flint-glass works generally—the soda is used in the form of carbonate instead of sulphate, and hence no fumes are evolved in these works which can be productive of appreciable nuisance in the vicinity. The furnaces in use appear to be managed in such a way as not to give rise to complaint on the score of smoke nuisance.

In the South Shields Bottle Works ware of such fine quality not being required, the ingredients used in the glass-founding are much coarser. The



constituents of the mixture in use there are sand, lime, marl, with a small quantity of rock-salt and manganese; as the result of the introduction of the salt there will be a certain evolution of hydrochloric acid: but the quantity used being apparently very small, I do not think the acid gas is given off in sufficient quantity to constitute any material nuisance.

Some complaints, however, have been made as to the quantity of smoke discharged from the cones of these works from time to time. This might be considerably mitigated if not abolished by the introduction of a special smoke-consuming apparatus, such as—for example—Frisbie's Patent which is in use at many glass-works, in which the fuel is introduced by an ingenious contrivance from below.

In the St. Hilda and the Maxwell Street Glass Works small flasks and medicine bottles chiefly are made. These works are of small size and the "metal" is made up principally of old and broken glass collected by marine store dealers and again melted down. In each there is only one furnace, and in these furnaces coke is the fuel used. In the annealing kilns a mixture of coke and coal is burnt. From the very limited amount of "chemicals" used in the process of fusion, and the extent to which coke constitutes the fuel burnt, these works do not appear to be obnoxious to the public health.

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### III.—GAS WORKS.

From the Gasworks no such acid vapours are discharged as are liable to escape from the Alkali works and Glassworks, and it is improbable that they exert any appreciable influence upon the public health. At certain stages of the processes carried on at such works, however, it is possible that nuisances may occur, and I think it is desirable that the Sanitary Authority should be informed as to the nature of those processes, and the points at which obnoxious emanations *may* arise.

As the Committee are doubtless aware the coal from which the gas is to be distilled is placed in closed retorts exposed to a very high temperature—in these works the temperature at which the retorts are wrought is about 2010°F. The retorts are set horizontally in "benches" in groups of seven around each furnace; each consists of a cylindrical fire-clay tube, diam. 16 inches, and they are so arranged that the hot air from the furnaces plays around them as it is led to the flues which in turn communicate with the chimney; when working properly the retorts attain a bright orange heat. Some of the retorts in use at these works are "through" retorts, that is open and capable of being charged at both ends,—these are 18ft. long: the "single" retorts are 10ft.



long. From the projecting mouth-piece of each retort the "ascension-pipe" rises, by it the gas generated in the retort is conveyed away. The fuel used in the furnaces is coke which is practically a smokeless fuel. The retorts are discharged and re-charged every six hours,—in the case of the through retorts simultaneously at each end. When the operation is to be performed—the retort-lids are removed, the coke residue from which the gas has been distilled is raked red-hot into iron barrows. The new charge of coal—generally about 4 cwt. is then rapidly shovelled in, and a ready-prepared luted lid is placed on the mouth of the retort and wedged tight. In the retort-house the most likely cause of nuisance is the charging of the retorts: I have timed the men employed in this operation and find that  $1\frac{1}{2}$  minutes are taken to charge a retort by the shovelling process, during this time a smoky tarry vapour is being given off. Mr. Warner the ingenious manager of these works has devised an apparatus which is in use in the Jarrow Gas Works by which each retort may be charged in a quarter of a minute: the introduction of such an apparatus into gasworks generally is a thing to be desiderated. In the quenching of the coke dense clouds of watery vapour are given off, which add considerably to the humidity of the local climate—this being especially appreciable in cold or wet weather, but it is difficult to see how it can be obviated.

The crude coal-gas passes over from the retort through the ascension-pipe into the hydraulic main—a large horizontal pipe which extends the whole length of the bench of retorts and collects the gas from the series: the main, being kept about half-full of condensed, chiefly tarry, matter, forms a trap or liquid valve to prevent the admixture of atmospheric air with the gas. From this the impure gas is led through a "scrubber" into the condensers—a series of vertical iron pipes, where it is exposed to the cooling influence of the air, and in these tarry matters are deposited, and part of the ammonia is condensed together with the watery vapour of the gas. From the condensers the gas passes to the "scrubbers"—small towers, 45 ft. high, containing tiers of "herring-bone" boards, that is boards placed slantingly in reverse directions in alternate tiers: over these boards water or weak ammoniacal solution is allowed to trickle, and the remaining ammoniacal impurity of the gas is condensed, forming the "ammoniacal liquor" of gas-works. The gas has now been freed from tarry matters and ammonia—its chief remaining impurities are Carbonic Acid, Sulphuretted Hydrogen, and Bi-sulphide of Carbon. In these works slaked (but not wet) lime alone is employed for the removal of these impurities. The lime is placed in trays, over which the gas is caused to pass, arranged in a series of four closed iron vessels, the most saturated of those being thrown out of series from time to time—and refilled. The chemistry of the process is this: the lime with the carbonic acid and sulphuretted hydrogen forms respectively carbonate and sulphide of lime: the sulphide of lime ( $\text{Ca S}$ ) unites with the bi-sulphide of carbon to form sulpho-carbonate of lime



(Ca C S<sub>3</sub>). These purifiers for the most part of the year are abundantly sufficient for the purification of the gas, but it is somewhat doubtful if they are adequate to the demands made upon them in the dead of winter when the process of gas production is at its height, a recent analysis of the gas (December 1882,) having indicated "23.68 grains of sulphur per 100 cubic feet, and some sulphuretted hydrogen," any escape of gas at this time giving rise to an exceedingly abominable effluvium. The "spent lime" from the purifiers, containing these sulphur compounds and other impurities is apt when exposed to the air to become a source of nuisance. As Dr. Ballard remarks, "volatile sulphur compounds are the most offensive of all chemical inorganic effluvia, and a very little of them in the atmosphere goes a long way where stink is concerned." The spent lime from these works, amounting on an average to about 10 carts a week during the winter, is deposited at "the Lawe," in the vicinity of the Recreation Ground, the Gas Coy. paying a man a small sum to cover it at once. This is a somewhat objectionable arrangement and one which is likely to give rise to trouble in the future. When visited the very disgusting odour of carbon di-sulphide was disagreeably appreciable in the vicinity: a certain *per centage* of this however must be placed to the credit of the town refuse which is also somewhat unfortunately deposited at this spot. With regard to the bestowal of the spent-lime I would remark that it is somewhat difficult to see why the Alkali Co.'s should be compelled to carry their tank-waste to sea, while the Gas Co. are allowed to form a local deposit of very analagous composition. I shall return to the question of the disposal of the town refuse on another occasion.

In these works the manufacture of the Sulphate of Ammonia is also carried on. In this process the ammoniacal liquor is run into a boiler heated in the usual way; by the heat the most part of the ammonia in the form of carbonate and sulphide is driven off and is led to the "saturator" into which sulphuric acid is also conveyed: Sulphate of Ammonia is thus formed and carbonic acid and sulphuretted hydrogen are given off—these latter are collected by means of a hood placed over the saturator, and are led away to the flue from the furnaces of the retort-bench. It would be a better arrangement if the sulphuretted hydrogen were passed into one of the furnaces directly and burnt: it is true that discharged as it is from a high chimney it is not productive of any appreciable nuisance in the district, still it forms a contribution to the general contamination of the atmosphere.

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In endeavouring to differentiate the influence (if any,) of the Chemical Works upon the health of the town I have been impressed from the first by the difficult nature of the inquiry. Arguments in sanitary matters are never susceptible of mathematical demonstration. So complicated are the sanitary relations in a highly civilized state of society such as ours and in the case of the more or less crowded populations of our large towns, so diverse are the influences warring against the public health—that it is difficult if not impossible to allocate to each its due part in the final result. And in a manufacturing district, such as for instance South Shields, the difficulty is at its maximum—the insanitary influences are so many, the contamination of the atmosphere springs from such various sources. It is so difficult also to estimate the bye-play among our working-class population of vicissitudes in manufacturing prosperity—the alternations of high wages and no wages at all—with the thriftlessness and careless habits of mind apt to be engendered thereby, these latter having a very real influence on sanitary conditions. In view of all this it is not perhaps surprising that very little has been attempted to be done in the way of investigation into the influence of Chemical Works on the public health: “guesses at truth” in this matter there have been many, but of detailed methodical inquiry carried out in a scientific spirit, in this country at least, I have not been able to find evidence of any with the exception of that carried out for the information of the Noxious Vapours Commission of 1876 by my predecessor Mr. Spear, now one of the Medical Inspectors of the Local Government Board. To this general remark I consider that a paper read by Dr. Lunge before the Newcastle-upon-Tyne Chemical Society in 1874, entitled “Contributions to Sanitary Statistics in connexion with Alkali Works,” does not constitute any real exception.

For the purpose of his inquiry Mr. Spear divided the town into three districts which he classed respectively as, I. exposed to the fumes of the Alkali Works; II. less exposed; III. not exposed. With this arrangement he calculated the death-rates for the year 1875—*a.* from all causes, *b.* from zymotic diseases, *c.* from inflammatory lung diseases, *d.* from phthisis, *e.* from scrofulous diseases of children and convulsions—in each division. To the results so obtained—though more carefully wrought out than any others with which I am acquainted—exception might perhaps be taken from the strictly scientific point of view, on the ground—first, that the figures are derived from the sanitary statistics of only one year—a method which sometimes proves misleading. Second, that the investigation was not sufficiently minute; the districts were too large, and thus there came to be included in the same division streets differing so widely in sanitary relations and social conditions as Wapping Street and Westoe (III.), Wellington Terrace and Waterloo Vale (II.), East Holborn (Johnson’s Hill, Cone Street, &c.,) and Frederick Street (I.). Again, a minor objection might be urged on the ground that the popu-



lation of the different divisions was "estimated" and not actually ascertained, and as all the statistics were calculated upon the basis of population any error in the estimation would vitiate the results under such heading.

On entering upon this inquiry I determined to eliminate as far as might be at all practicable all such sources of fallacy. With the object of obviating the first of the above stated difficulties I have taken the sanitary statistics of *five* years—the years 1878–82. It has been necessary for me in pursuing the investigation to go over the birth registers of the town for five years, the death registers for three—classifying the entries in each case according to the streets in which the occurrences took place, in the case of the deaths also classifying them according to age and disease. In view of the second difficulty, but also for the general sanitary-statistical purposes of the future, I have considered it desirable to break up the town into very much smaller divisions than had been adopted in connection with the sanitary statistics of the past. I am of opinion that so long as in towns areas of considerable size and occupied by populations under the most various sanitary conditions are taken as the bases for sanitary statistics, it will be impossible to make these statistics serve in any way as an analysis of sanitary conditions. I have therefore divided the town into 63 sanitary "sections": the ideal unit of population for these sections I have taken as 1000—believing that that number furnishes a basis for annual statistics sufficiently large to avoid the fallacies appertaining to the manipulation of small numbers. I have not however set up that number as an arbitrary standard—I have not classed together streets in evidently different sanitary circumstances for the purpose of making up a population of 1000, indeed several of the sections have been allowed to fall considerably short of the ideal standard rather than group streets in an artificial manner. My effort has been to place together streets (terraces, courts, or "hills") adjacent, and as far as possible in the same sanitary and social footing. In this classification I have been much aided by the local knowledge and experience of the Sanitary Inspector. The third objection, in so far as population has been made the basis of my investigation is nullified by the results of the street-by-street enumeration of the population which the Sanitary Authority empowered me to carry out and which has placed in my hands the exact population of each street in the town. The appearance of this report has been considerably delayed by my determination in its preparation to take advantage of the results of the census: the census proved to be a work of considerably greater difficulty than had been anticipated, and the working up of its results has added materially to the laboriousness of the inquiry.

Before proceeding to state the result of my statistical investigation I may be permitted to glance for a moment at some of the current ideas with regard to the influence of chemical works in a district upon public health.



The blighting effects of the acid fumes from alkali and glass works on vegetation is very generally appreciated and probably over estimated.\* It is argued that an influence so detrimental to vegetable life must be more or less injurious to the health of susceptible subjects such as children and delicate adults. And there is no doubt that this reasoning is entitled to a certain consideration. As qualifying the argument, however, it must be remembered that animal life is possessed of a much greater power of accommodation to surrounding circumstances than is the case in the vegetable kingdom. Apart from any such direct effect, however, I am persuaded that the presence of pungent gases in the atmosphere to any appreciable extent will tend indirectly, at least, to the deterioration of the public health, because of the inevitable tendency it produces on the part of the community towards the hermetical closure of windows and doors and the consequent limitation of that household ventilation which is so necessary for the public health. It has been argued however as a *per contra* that the presence of these antiseptic gases in the atmosphere “extirpates some of the microscopic germs floating in the air and thus mitigates the spread of zymotic diseases:” or, as it has been ironically put, that a normal constituent of the atmosphere had been originally omitted and that chemical works had arisen to supply the deficiency. This argument is however evidently fallacious, as in the degree of dilution in which these acid gases exist in the atmosphere even in the vicinity of alkali works they can have no real antiseptic power. Baxter, in the course of some experiments with sulphurous acid quoted by Professor Parkes, found that “with 58 per cent. (of sulphurous acid) the poison of infective inflammation was still active,” and of course the acid gases are not present in the atmosphere even in the immediate vicinity of alkali works in anything like that proportion. The fact of the exceptionally severe visitation of South Shields by small pox in 1871 (in which year about 4000 people, or nearly one-tenth of the population, were attacked by the disease) indeed creates a large presumption against the idea of the anti-zymotic influence of chemical works.

For the purposes of this inquiry I have taken as an area more particularly exposed to the fumes from alkali works sixteen streets situated in close proximity to the Tyne Alkali Works—all of them with the exception of a small part of one (Maxwell Street) within a radius of 1000 feet from the works,†

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\* Chemical works situated in manufacturing districts must not be credited with anything like the total injury which falls upon plants and trees in the neighbourhood: there is no doubt that the extensive consumption of coal and consequent production of sulphuric acid gas materially contributes to the same results.

† These streets are Albert Terrace, Charlotte Terrace, Claypath Lane, Cuthbert St., Derby St., Derby Terrace, Edward St., George St., Martin St., Maxwell St., Pallister St., Peel St., Percy St., Smith St., Sunny Terrace, Wilson St.—these streets may be taken as a fair average of the streets in which *the mass of the population* is aggregated, and considerably above the level (from the general sanitary point of view) of the Holborns—Waterloo Vale—and the “Low” part of the town.



and comprising in all a population of 4548—a sufficiently large number especially when a quinquennial period of observation is taken. The Tyne Alkali Works is exceedingly well adapted to the purposes of the inquiry: the populations in the immediate proximity of the other alkali works and to the Tyne Plate Glass Works are too small to enable me to make them the basis of a detailed investigation. In order to make a satisfactory and thorough analysis of the sanitary condition of this “exposed” district I have classified the deaths occurring therein during the last five years and calculated the general death-rate, the proportion of deaths of children under one year to the total number of births, and the proportion respectively of deaths of children under five, deaths from zymotic diseases, deaths from phthisis, and deaths from inflammatory lung diseases—to the total deaths. A similar series of calculations has been made for each of the sixty-three sections into which the town has been divided; and the results obtained in connection with the “exposed division” have been compared with the *means* and with those of the individual sections. The results brought out by these calculations are not striking—the scientific mind is disposed now-a-days to receive “striking” results in matters sanitary with some scepticism; but I think, having been attained by much pains-taking labour and with much care to avoid sources of fallacy, that they form a contribution of some value to a scientific settlement of the question of the influence of chemical works on the public health. I may remark here that it is evident that the results would have been more decisive if the streets included in the “exposed divisions” had been excluded from the individual sections, and still more so if the influence on the other sections of the other chemical works could have been eliminated.

*1st. General deathrate.*—I found after a little consideration that it would be fallacious to base the calculation of the deathrate of the sections for the quinquennial period on the population as now ascertained—from the fluctuations in the population and the number of new houses constantly being put in occupation all over the town: I have therefore taken the deathrate for only the last year, 1882. I find that in the selection of streets which I have styled “the exposed division” the deathrate was 23·7, the mean deathrate of the town in the same period was 20·8—the deathrate of the exp. div. was thus 2·5 *above* the mean, otherwise stated—41 sections of the town had a lower deathrate than the exp. div.\* I should however lay little stress on these figures, applying as they do to only one year, were not their tenor supported by others which follow.

*2nd. Infantile Mortality.*—The deaths of children under one year old calculated on the number of births during the quinquennial period 1878–82 indicates in the exp. div. a rate of 16·9 per cent., the mean of the sections

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\* The detailed figures for each section will be found in the Annual Health Report for 1882.

was 14·2—the rate in the exp. div. was thus 2·7 *above* the mean, otherwise stated—47 of the 63 sections of the town had a lower rate of infantile mortality. The infantile mortality is usually considered the most delicate test of the sanitary condition of a locality, and the one least open to fallacy.

*3rd. Percentage of deaths of children under five years old, calculated on the total deaths—five years 1878-82.*—In the exp. div. 60·5, the mean of the sections generally was 49·1—*excess* in the exp. div. 11·4. 53 of the 63 sections of the town had a lower deathrate.

*4th. Percentage of Zymotic deaths to total deaths, 1878-82.*—In the exp. div. 21·5, the mean of the sections was 19·6—*excess* in exp. div. 1·9. 41 sections had a lower Zymotic rate.

*5th. Percentage of deaths from Phthisis to total deaths, 1878-82.*—In exp. div. 6·0, in the sections generally the mean was 8·8—*excess* of sections generally *over* exp. div. 2·8. Only 20 of the 63 sections had a lower deathrate from Phthisis.

*6th. Percentage of deaths from Inflammatory Lung Diseases to total deaths, 1878-82.*—In exp. div. 19·0—mean of sections 17·1—*excess* in exp. div. 1·9 42 sections had lower deathrates from pulmonary diseases.

The most salient points brought out by these figures as regards the district particularly exposed to the fumes from the alkali works are, 1. The generally higher deathrate. 2. The excessive mortality of children under five years of age. 3. The fact that there is no diminution in the zymotic rate. 4. The appreciably lowered deathrate from consumption—this latter is more clearly brought out when stated as—that the phthisical percentage *under the mean* was 46 per cent. of the total phthisical percentage ( $\frac{2\cdot8}{6\cdot0} \times 100$ ). 5. The slightly heightened pulmonary rate.

After so lengthy a report any elaborate periscript would be out of place. I think it right however before concluding to express my sense of the courtesy with which my visits to the various chemical works in town have been received, and the evident wish which has always been exhibited by the managers to reduce to a minimize any offence to the public apt to arise out of the processes carried on in these works.



